DATA RECOVERY INVESTIGATIONS OF THE WEST WATER STREET SITE 36CN175, LOCK HAVEN, CLINTON COUNTY, PENNSYLVANIA

FINAL REPORT

U.S. Army Corps of Engineers,
Baltimore District

Prepared by: ***KFS Historic Preservation Group***
Kise Franks & Straw
Philadelphia, Pennsylvania

Jay F. Custer, Principal Investigator
University of Delaware Center
for Archaeological Research
Newark, Delaware

1 February 1994

US Army Corps
of Engineers
Baltimore District

DATA RECOVERY INVESTIGATIONS OF THE WEST WATER STREET SITE
36CN175
LOCK HAVEN, CLINTON COUNTY, PENNSYLVANIA

by

Jay F. Custer, Scott C. Watson, and Daniel N. Bailey

FINAL REPORT

U.S. Army Corps of Engineers,
Baltimore District

Prepared by: KFS Historic Preservation Group
Kise Franks & Straw
Philadelphia, Pennsylvania

Jay F. Custer, Principal Investigator
University of Delaware Center
for Archaeological Research
Newark, Delaware

1 February 1994

ABSTRACT

The West Water Street Site is a multi-component, stratified prehistoric archaeological site located on the West Branch of the Susquehanna River along Water Street in the town of Lock Haven, Clinton County, Pennsylvania. Phase III data recovery excavations were conducted at this site by Kise, Franks, and Straw, Inc. (KFS) and the University of Delaware Center for Archaeological Research (UDCAR) for the Lock Haven Local Flood Protection Project. This work was undertaken in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended. The purpose of this work was to mitigate the adverse affects of the construction of a levee on significant archaeological resources at the West Water Street Site.

Phase I excavations, consisting of excavation of deep shovel test pits and bucket augering, initially identified buried archaeological deposits at the West Water Street Site. Subsequent Phase II testing, consisting of excavation of 5 x 5' squares to depths of 2 - 3 m, identified five prehistoric components which ranged in depth from approximately 50 cm to 3 m below the existing ground surface. These occupations appeared to be intact, and included a Contact Period occupation ca. A.D. 1700-1730, a Late Woodland/Clemson Island occupation ca. A.D. 1000-1300, a Late Archaic-Middle Woodland occupation ca. 3000 B.C.- A.D. 1000, a Middle Archaic occupation ca. 6000-5000 B.C., and an Early Archaic/Late Paleo-Indian occupation ca. 8000-7000 B.C. All of these archaeological resources were determined to be eligible for inclusion in the National Register based on the Phase II testing, and Phase III data recovery excavations were undertaken to recover the information contained at the site.

Based on the Phase II excavations, the top cultural levels (Contact through Late Archaic) were thought to be preserved in discrete stratigraphic contexts. However, when larger areas were opened during the Phase III excavations, it was found that the post-Late Archaic deposits were mixed together within a single stratigraphic unit. Excavation of these deposits yielded significant data nonetheless.

Excavation of the Contact component produced numerous artifacts from that period, including European manufactured trade goods, as well as a number of pit features. One of the features contained human skeletal remains. Unfortunately, the context of the Contact Period artifacts and features was found to be disturbed. The occupation was ephemeral, but appeared to be the result of small, individual family groups living at the site, as opposed to a large village settlement.

A very large number of artifacts and over 500 features were recovered from the Clemson Island occupation of the site, but like the Contact occupation, all of the data came from a disturbed context. Nevertheless, important information was

retrieved. Numerous occupations of the site were found to have taken place during Clemson Island times, and some may have reached the size of fortified hamlets consisting of multiple families. Evidence of a stockade surrounding at least one, and possibly two, houses was found. Also, specific areas of the site appeared to have been used for specialized activities, such as food storage.

Phase III testing of the Late Archaic-Middle Woodland occupation of the West Water Street Site revealed the presence of numerous diagnostic artifacts from this period, but they were all recovered from disturbed contexts. An extensive Late Archaic habitation was encountered which included numerous Susquehanna broadspears and rhyolite and steatite artifacts, but the disturbed nature of these artifacts greatly limited the amount of information obtainable from this component.

The excavation of the Middle Archaic component of the site provided a wealth of important information that generally met or exceeded expectations. Over 40 projectile points of the Neville/Stanly variety were recovered, as were a number of other points from this period. In addition, a wide range of artifacts from the tool kits of the Middle Archaic occupants were found, from intact contexts. Analysis of artifact distributions across the site indicated that Middle Archaic occupations were small campsites of individual families who repeatedly visited the area over time. A radiocarbon date obtained from this component indicates that at least one of these occupations was ca. 6200 B.C.

Excavation of the Early Archaic/Late Paleo-Indian occupation of the site produced three projectile points of the Kirk/Palmer variety, as well as other stone tools and debitage. An analysis of the artifacts indicated a great deal of continuity between Early Archaic/Late Paleo-Indian tool forms and those of earlier and later periods. A total of four separated artifact deposits in this component were encountered at the West Water Street Site.

Other information recovered from the site includes detailed data on soil deposition and formation processes taking place along the West Branch of the Susquehanna River. In all, data recovery excavations at the West Water Street Site produced significant information that has much enhanced our understanding of prehistoric cultures, in both the West Branch Valley and the Middle Atlantic region as a whole.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

Page

Page

Page

Page

List of Plates

LIST OF TABLES

Page

Page

INTRODUCTION

The purpose of this report is to summarize the results of Phase III data recovery excavations undertaken by Kise, Franks & Straw Inc. (KFS) and the University of Delaware Center for Archaeological Research (UDCAR) at the West Water Street Site (36CN175) for the Lock Haven Area Flood Protection Project and the Baltimore District of the U.S. Army Corps of Engineers (Figure 1). The overall objective of this project was to recover significant archaeological data from the West Water Street Site. The fieldwork for the data recovery excavations was undertaken between October 1992 and April 1993.

Project Design and Impacts

The town of Lock Haven and its surrounding communities have been flooded by the West Branch of the Susquehanna River 18 times in the past 125 years (U.S. Army Corps of Engineers 1975:58). The town's location just upstream from the confluence of the West Branch and Bald Eagle Creek places it in a particularly flood-prone area. The average height of recorded floods is 1.1 m (3.6 ft.) above flood stage, and the highest recorded flood was 3.4 m (11.3 ft.), occurring in 1936. In 1972, a flood resulting from Hurricane Agnes crested just shortly below this, at 3.1 m (10.3 ft.) above flood stage, causing major damage. Two years later, the Corps of Engineers began preliminary designing for flood protection for the City of Lock Haven.

The current plan for flood protection in and around Lock Haven was established by the Corps in 1979, and calls for a 5.4 m (17.7 ft.) high levee and floodwall system that would enclose most of the low-lying areas between the West Branch of the Susquehanna and Bald Eagle Creek. The length of this flood protection system would be approximately 9144.0 m (30,000 ft.), and its construction would involve the repositioning of two roads and an airport runway, in addition to the construction of pumping stations and drainage structures. Closure structures would also be built at low elevation entry points into Lock Haven, effectively enclosing the entire town.

Current plans for flood protection in Lock Haven call for a 5.4 m (17.7 ft.) high levee with a basal width of 30.5 m (100.0 ft.). The levee will have a 1.8 m (6.0 ft.) deep trench running along its centerline to join it to the ground. The typical width of this trench will be 5.5 m (18.0 ft.), and it will be trapezoidal in cross-section. The width of the entire construction corridor for the levee can be up to, but no more than, 45.7 m (150.0 ft.), and the conditions of the physical terrain and property limitations will influence the final design. Construction of a footing for the levee will extend to a depth of at least 30 cm (12 in.) below present ground surface across the entire construction corridor. The U.S. 220 causeway will be used as part of the levee embankment in that section of the project.

FIGURE 1

Project Location

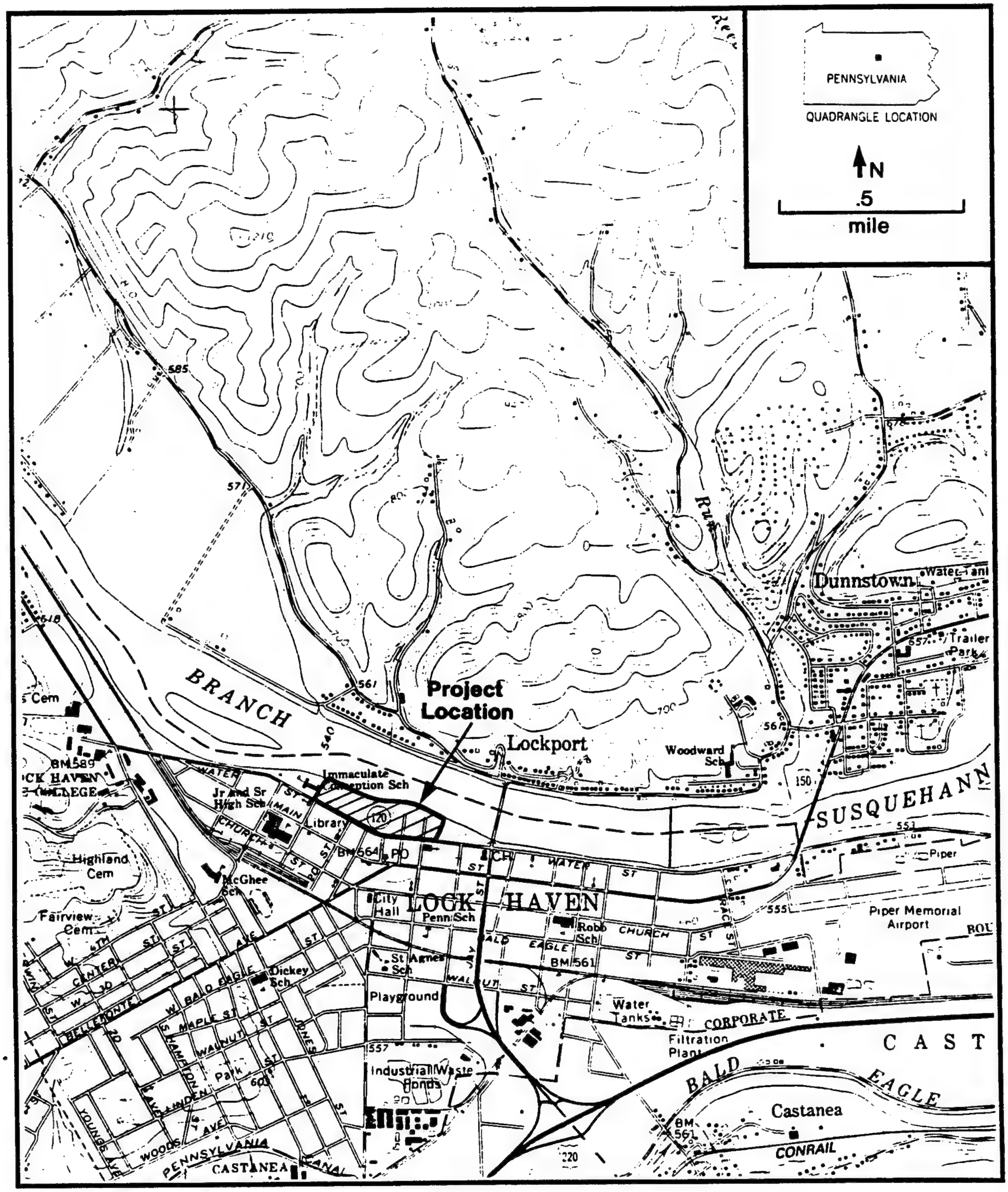
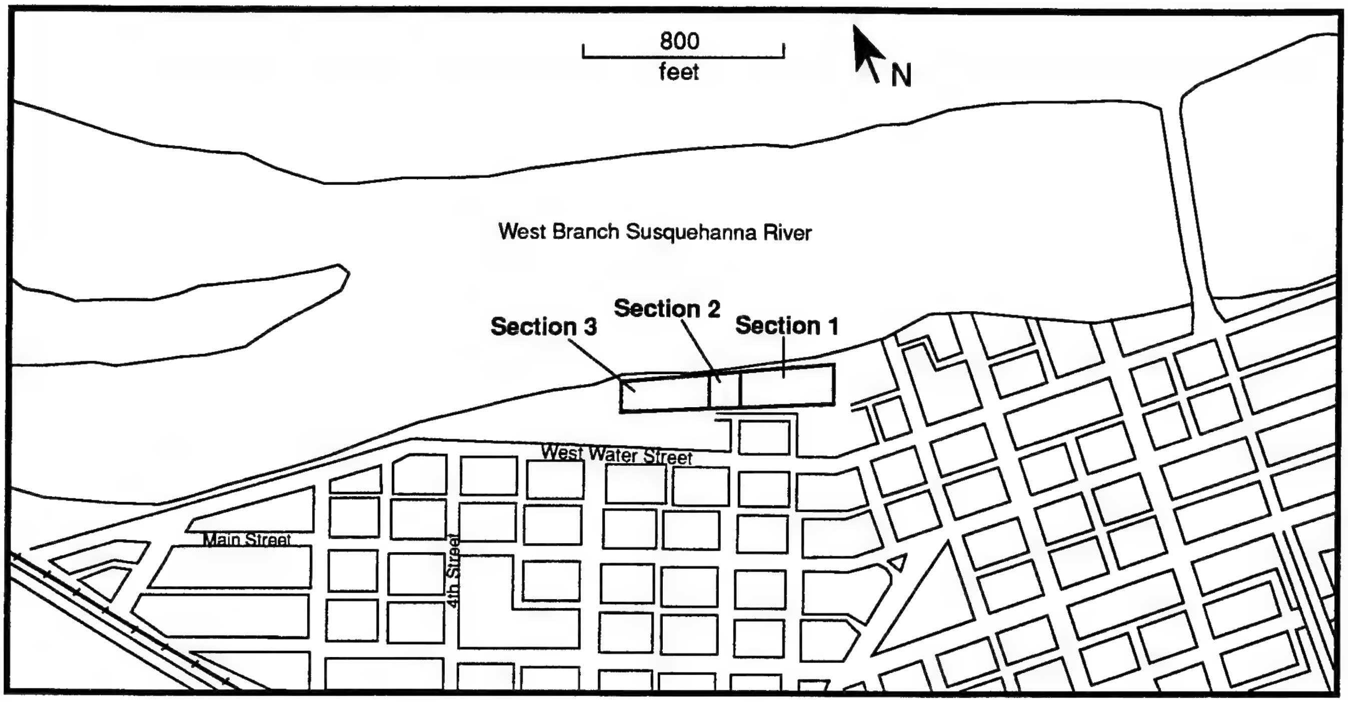


FIGURE 2

West Water Street Site, 36CN175, Project Areas



The project design in the Water Street vicinity, from Jay Street to Forth Street, will follow the descriptions noted above. In this section, the levee design will involve construction along approximately 900 m (3000 ft.) of Water Street, with an average width of 30 m (100 ft.).

Environmental Setting

The project area is located within the floodplain of the West Branch of the Susquehanna River, along Water Street, Lock Haven, Clinton County, Pennsylvania (Figure 1). The project area has been divided into three contiguous sections (Figure 2). These sections also include four smaller segments with Segments A, B, and C falling within Section 1 and Segment D falling within Section 3 (Figure 3).

The project area is located on the northern border of the Ridge and Valley physiographic province of Pennsylvania, adjacent to the Appalachian Plateau province to the west. It is currently part of the residential and commercial area of Lock Haven. Present land use includes domestic housing, small businesses, and schools. The entire project area lies within the watershed of the West Branch of the Susquehanna River and its tributary, Bald Eagle Creek. Much of the modern land surfaces have been severely disturbed by construction, grading, filling, and, in certain locations, cultivation. Varying amounts of historic fill blankets most of the project area, and the modern landscape is only a little more than a century old. Thus, early historic and

FIGURE 3

Phase III Sections and Segments of the West Water Street Site, 36CN175

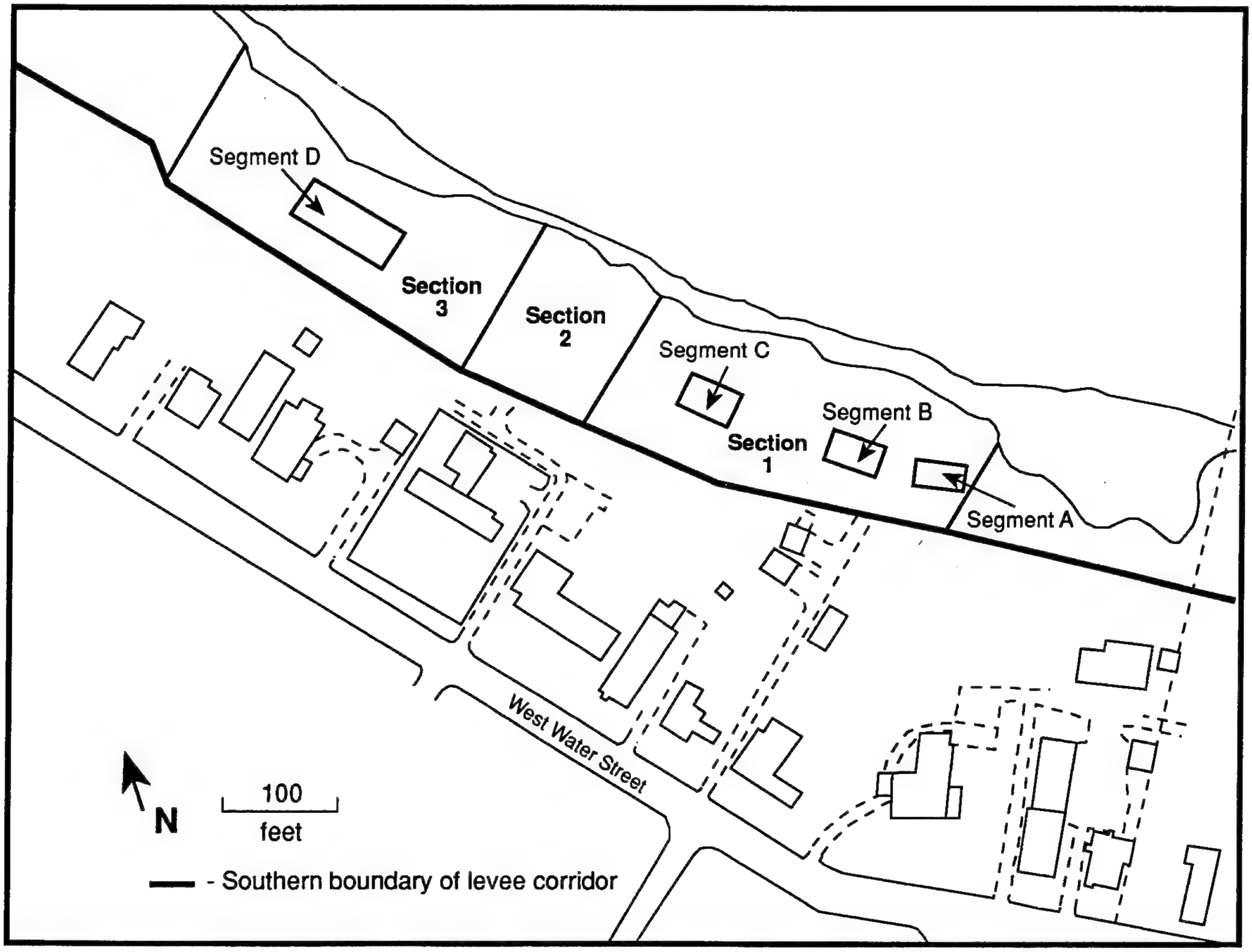


TABLE 1

Past Environments of the Study Area

Dates	Floodplains and Terraces	Uplands
10,050 B.C. - 6050 B.C.	Boreal forest of spruce with bogs and floodplain swamps	Closed boreal forest of spruce; some upland bogs
6050 B.C. - 3050 B.C.	Hemlock-oak forest: hydrophytic oak gallery forest; many floodchute swamps	Hemlock-oak forest
3050 B.C. - 1050 B.C.	Oak-hickory forest; hydrophytic oak gallery forest; open grass-lands; some floodchute swamps	Oak-hickory forest
1050 B.C. - Present	Oak-chestnut-maple gallery forest; fllodchute swamps	Oak-chestnut-beech-hemlock forest

prehistoric landscapes are buried beneath the recent fill deposits.

Prior to the advent of historic settlement, most of the project area was covered by a mixed deciduous forest dominated by oak and chestnut with some maple, beech, and hemlock (Shelford 1963). This mixed deciduous forest varied in composition based on elevation and proximity to water courses. The specific project area was probably characterized by hydrophytic species such as oaks, maples, and gum. The upper elevation terraces and slopes would have been characterized by chestnut, beech, and hemlock. Little of this original vegetation remains in the local area due to deforestation from logging.

During the prehistoric past, there was a great deal of environmental change in the project area. The project area was within the range of glaciated territory in northern Pennsylvania and local environments and climates were severely affected by the great ice sheets of the Late Pleistocene period, and associated air masses, until approximately 9000 years ago (Carbone 1976). As the ice sheets receded, their effects upon local climates and environments ameliorated and a variety of changes in local environments occurred. Table 1 lists the varied environmental changes which occurred in the project area and adjacent upland areas during the past 15,000 years. It can be noted that throughout the past 15,000 years the lowland floodplains of the West Branch Susquehanna River would have been especially attractive locales for human settlement. Both prehistoric and historic period cultures were drawn to the rich resources of its environs.

Regional Prehistory

In order to understand the context of the potential prehistoric cultural resources of the study area, it is important to review the regional prehistoric archaeological record. The prehistoric archaeological record of the Middle Atlantic region has traditionally been divided into three major cultural periods: the Paleo-Indian, Archaic, and Woodland Periods. The Archaic and Woodland Periods are also divided into Early, Middle, and Late sub-Periods based on similarities in settlement/subsistence patterns and technologies. The prehistory of the project area will be summarized by five blocks of time: the Paleo-Indian/Early Archaic Period (ca. 10,050 B.C. to 6500 B.C.), the Middle Archaic Period (ca. 6500 B.C. to 3550 B.C.), the Late Archaic/Early-Middle Woodland Period (ca. 3550 B.C. to A.D. 950), the Late Woodland Period (ca. A.D. 950 to A.D. 1620), and the Contact Period (ca. A.D. 1620-1750). Each of these periods is described below and the descriptions are summarized from Custer (1984), Custer and DeSantis (1986), Turnbaugh (1977), Louis Berger and Associates (1983), Hatch et al. (1979, 1985), Rasson and Evans (1980), Goodwin and Associates (1988), Hay (1987), Fitzgibbons and Vento (1987), U.S. Army Corps of Engineers, Baltimore District (1987), Cohen, Neumann, and Hinks (1989), Vento and Fitzgibbons (1989), and Neumann (1989).

Paleo-Indian/Early Archaic Period (10,050 B.C. - 6500 B.C.). The Paleo-Indian/Early Archaic Period encompasses the time period of the final disappearance of Pleistocene glacial conditions from Eastern North America and the establishment of more modern Holocene environments. The distinctive feature of the Paleo-Indian Period is an adaptation to the cold, and alternately wet and dry conditions at the end of the Pleistocene and the beginning of the Holocene. This adaptation was primarily based on hunting and gathering, with hunting providing a large portion of the diet. Hunted animals may have included a variety of cold adapted fauna including mammoth, mastodon, musk ox, caribou, and moose as well as more modern fauna such as white-tailed deer. Evidence from the Shawnee-Minisink site in the Upper Delaware River Valley indicates riverine and plant food resources were also being exploited at this time (Kauffman and Dent 1982). Boreal forests of spruce and pine would have provided a number of productive habitats for these game animals. Watering areas in the study area floodplains would have been particularly good hunting settings.

Tool kits of Paleo-Indian groups were oriented toward the procurement and processing of hunted animal resources. Tool kits would have included a variety of items such as scrapers, knives, bifaces, gravers, tabular flake cores and various flake tools. Lithic technologies were based on a biface and flake industry adapted to both primary and secondary lithic sources. During the Early Archaic, some additional stone tool types for processing plant foods may have been added. A preference for high quality lithic materials has been noted, with possible sources being Pennsylvania jasper from the Lehigh Hills and Onondaga cherts from New York. Careful resharpening and maintenance of tools was common. A lifestyle of movement among game attractive environments has been hypothesized with social organizations based upon single and multiple family bands. Throughout the 4000 year time span of the period, the basic settlement structure remained relatively constant with some modifications being seen as Holocene environments appeared at the end of the Paleo-Indian Period.

Numerous Paleo-Indian/Early Archaic sites have been recorded in northcentral Pennsylvania, but most consist of isolated surface finds or plow disturbed sites. Fluted points, the distinctive tool of the Paleo-Indian Period, have been found in the Ridge and Valley Province from scattered surface finds only. Hatch et al. (1979) note that Paleo-Indian site locations in the study area are sporadic and random, but are generally located in areas away from the Susquehanna River. The Shoop site, for example, is located on a hill several miles east of the Susquehanna River (Witthoft 1952). Research in the southern portion of the Ridge and Valley Province suggests that sites from this time period are functionally specific, and consist of quarry sites and reduction stations, quarry-related base camps, base camp maintenance stations, and outlying hunting sites (Custer 1984; Hatch et al. 1985).

Early Archaic sites are not well represented in northcentral Pennsylvania (Turnbaugh 1977), and in some areas these sites are often located in the same settings as Paleo-Indian sites. A general continuum is seen with the Paleo-Indian Period, but more, and different, environmental zones seem to be exploited during Early Archaic times. The Early Archaic is stratigraphically represented in Pennsylvania at the Sheep Rock Shelter, Huntingdon County (Michels and Smith 1967).

Middle Archaic Period (6500 B.C. - 3550 B.C.). The Middle Archaic Period is characterized by a series of adaptations to the newly emerged full Holocene environments. These environments differed from earlier ones and were dominated by mesic forests of hemlock and oak, which were in place in portions of the Ridge and Valley Province by 6050 B.C. (Hatch et al. 1985). A reduction in open grasslands in the face of warm and wet conditions caused the extinction of many of the grazing animals hunted during Paleo-Indian times; however, browsing species such as deer flourished. Adaptations changed from the hunting focus of the Paleo-Indians to a more generalized foraging pattern focused on a broader resource base in which plant food resources would have played a more important role. Deer, turkey, migratory waterfowl, and anadromous fish were also exploited. Base camp sites are found in floodplain and low terrace settings of major streams and are located in areas which contain a wide variety of resources. Hatch et al. (1979) have identified seven other types of Archaic sites in the Ridge and Valley Province which include valley hunting camps, lithic quarry sites, hollow entrance and hollow source camps, marsh exploitation camps, rockshelters, and lakeshore camps. This complex system of functionally different site types, some of which appear in areas of high topographic relief, indicate adaptations to more varied resource settings (Custer 1984:69). Valley floors are often the location of Archaic sites (Hatch et al. 1979). These sites represent small group activities, and usually contain a limited variety of artifacts. They may have been occupied on a seasonal or as-needed basis.

Tool kits were more generalized than earlier Paleo-Indian tool kits and show a wider array of plant processing tools such as grinding stones, mortars, and pestles. Ground and polished implements such as adzes, axes, and spearthrower weights are also found during this time. The addition of these artifacts to Middle Archaic tool kits reflects the growing importance of plant food processing and heavy woodworking. In central Pennsylvania, the utilization of different lithic resources has been documented for this time period, and may relate to the exploitation of newly emerging environments (Stewart 1980a, 1980b). The focus on high quality lithics is not as apparent as in earlier periods (Rasson and Evans 1980). A mobile lifestyle was probably common with a wide range of resources and environmental settings utilized on a seasonal basis. A shifting band-level organization which saw the waxing and waning of group size in relation to resource availability is evident.

Late Archaic/Early-Middle Woodland Period (3550 B.C. - A.D. 950). The Late Archaic Period can be correlated with a dramatic change in local climates and environments that seem to have been a part of events occurring throughout the Middle Atlantic region. A series of periodic warm and dry climatic episodes set in and occurred sporadically from ca. 3050 B.C. to 1050 B.C. The early parts of this time period experienced climatic oscillations, causing fluctuations in tree and plant species and their distributions. Climatic shifts after 850 B.C. were probably minor variations of modern patterns. Mesic forests were replaced by xeric forests of oak and hickory, and grasslands again became common. Environments probably consisted of moderately mature deciduous forests with understories of mixed grasses, sedge, and woody shrubs, and modern faunal assemblages were probably established by 850 B.C. Some interior streams dried up, but the overall effect of the environmental changes was an alteration of the environment, not a degradation.

The major changes in environment and resource distributions caused a radical shift in adaptations for prehistoric groups. Important areas for settlements included floodplains, small knolls in valleys between mountain ranges, and a variety of areas with higher topography (Hatch et al. 1979). Competition for resources and realignments of group organizations may be responsible for this focus.

Late Archaic/Early-Middle Woodland tool kits show some minor variations as well as some major additions from previous Middle Archaic tool kits. Plant processing tools became increasingly common and seem to indicate an intensive harvesting of wild plant foods that may have approached the efficiency of horticulture by the end of this period. Chipped stone tools changed little from the preceding Middle Archaic Period; however, more broad-bladed knife-like processing tools became prevalent. Raw material procurement was based on both primary and secondary lithic sources. Polished celts, bone harpoons, gorgets, pendants, and stone and ceramic pipes are found on sites from this period. Also, the presence of a number of non-local lithic raw materials indicates that trade and exchange systems with other groups were beginning to develop. The use of argillite is considerably greater during this period compared to earlier periods. Caches of stone tools also appeared for the first time and their storage may indicate the seasonal reoccupation of certain types of sites.

The addition of steatite, and then ceramic containers is also seen. Early forms of prehistoric ceramics resembled stone bowls, and crushed steatite was used as a tempering agent. Other early forms of ceramics such as Vinette I may be contemporaneous with steatite-tempered wares. Later ceramics are conoidal in shape with cord and net impressions. These items allowed more efficient cooking of certain types of food and may also have functioned as storage vessels for surplus food resources. Subsistence resources in this time period would include terrestrial fauna, fish, shellfish, and a variety of plant foods. Storage pits and human burials are also known from this period.

Social organization seems to have undergone radical changes during this time. With the onset of relatively sedentary lifestyles and intensified food production, which might have produced occasional food surplus, incipient ranked societies may have begun to develop. The presence of extensive trade and exchange networks and some caching of special artifact forms also indicate increasing social complexity.

Sites from this time period are very sparse in northcentral Pennsylvania. However, two Early to Middle Woodland sites that have been excavated in this region include Sheep Rock Shelter (Michels and Smith 1967) and 39LY37, a village site (Turnbaugh 1977).

Late Woodland Period (A.D. 950 - A.D. 1620). The Late Woodland Period in northcentral Pennsylvania has been traditionally divided into three sub-periods: Clemson Island, Shenk's Ferry, and Susquehannock. The period is generally characterized by more sedentary lifeways, as well as by the emergence of horticulture/agriculture. Hatch et al. (1979) have noted that settlement patterns for this time show a continuity with the Late Archaic, Early/Middle Woodland Period, with a focus on areas adjacent to major water courses with good agricultural soils. Clemson Island base camps are located in these areas, and are sometimes associated with burial mounds (Hay and Hatch 1987). Limited activity sites are also noted for these groups, as is evidence of maize and bean use (Goodwin and Associates 1988).

Clemson Island sites in central Pennsylvania include: the Nash Site (36CN17; Smith 1972, 1976), the Ramm Site (36CN44; Smith 1972, 1976), the Miller Site (36CN97; Smith 1972, 1976), the Mill Hall Site (36CN101; Hay and Hamilton 1984), and the Brock Mound and Village Site (36CN1; Turnbaugh 1977).

Evidence of stockaded villages is known for Shenk's Ferry groups, which also occupied smaller farming hamlets located away from the major rivers (Goodwin and Associates 1988; Hatch et al. 1979, 1985). These hamlets may have been occupied by a portion of the population on a semi-permanent, seasonal basis, while the occupation of larger villages was year round (Hatch et al. 1985). A significant Shenk's Ferry stockaded village site in northcentral Pennsylvania is the Bull Run Site (36LY119; Bressler 1980).

Susquehannock groups first appeared in the area ca. A.D. 1500, and they occupied scattered villages (Goodwin and Associates 1988). The Quiggle Site (36CN6; Smith 1976) is a large, stockaded Susquehannock village site located in northcentral Pennsylvania. This site had multiple stockade and structure construction episodes (Vento and Fitzgibbons 1989). A small, special purpose Susquehannock site in the area is represented by the Fisher Farm Site (36CN36; Hatch 1980, 1983).

Late Woodland lithic assemblages are noted to be comparable to those of earlier groups (Hatch et al. 1985). Changes in

ceramic forms include the appearance of decorated and incised wares. In general, Late Woodland sites occur in environmental settings similar to those of the Late Archaic/Early-Middle Woodland Period, with some slight increases in sedentism. Procurement sites and transient camps are still found, and intensive plant utilization and hunting remained the major subsistence activities up to the time of European Contact.

Contact Period (A.D. 1620-1750). The arrival of European explorers, traders, and colonists marked the beginning of the end of Native American lifeways in Pennsylvania. Native populations in the Ridge and Valley area consisted primarily of dislocated groups such as the Lenape, Munsee and Shawnee arriving from other parts of the Middle Atlantic. Several contact sites are noted from this region, such as the Great Island and Dunnstown sites, both just east of Lock Haven (Turnbaugh 1977). Both have provided many trade goods. European trade items are widely reported being found in this area, and are sometimes associated with Native American burials such as those at 36CN7 near the Great Island (Meginness 1889). Disease and warfare decimated Native American populations, and by the beginning of the nineteenth century, most Native Americans had departed from northcentral Pennsylvania.

Regional History

This brief historical overview is abstracted from Hay (1987), Fitzgibbons and Vento (1987), U.S. Army Corps of Engineers, Baltimore District (1987), Cohen, Neumann, and Hinks (1989), Vento and Fitzgibbons (1989), Neumann (1989), and Benenson and Franks (1990).

The earliest European settlement in Lock Haven occurred in the second half of the eighteenth century. By the 1760s, a sparse settlement of Scots-Irish farmers had been attracted to the fertile floodplains of the Susquehanna River and Bald Eagle Creek (Goodwin and Associates 1988:14). Although treaties and land transactions between these European settlers and the Indians who inhabited the area took place, relations between these two groups remained volatile. Ultimately, alliances between the Indians and the British during the Revolutionary War prompted an exodus of settlers who fled to Fort Augusta at Sunbury in what came to be known as the "Great Runaway" (Benenson and Franks 1990).

After hostilities ceased, farmers returned and resettled the area surrounding "Old Town," near present-day Lock Haven. At this time, the area was primarily agricultural with grist mills established to facilitate the preparation of grain. After the turn of the nineteenth century, timber, which was plentiful along the Susquehanna River, was being sought by distant markets in the east. The availability of this commodity and the accessibility of river transport, along with fertile agricultural land, would combine to establish a flourishing industrial and economic center in the area of Lock Haven.

The economic and industrial status of Lock Haven was further secured by the establishment of a canal system and dam on the Susquehanna River in the 1830s, and the construction of a boom in 1849 to facilitate the processing of lumber. These events firmly established a timber industry in Lock Haven, with the resulting establishment of saw mills, planing mills, and furniture and sash and door factories (Verto and Fitzgibbons 1989). Additional supporting industries included tanneries and ironworks. All of these industries drew numerous skilled and unskilled laborers to the area and fostered the further expansion of the town.

The decline of this "golden era" commenced with a series of floods in the 1860s and 1870s which forced the closing of some of the mills. In addition, a devastating fire in 1862 leveled much of the commercial district in the vicinity of Water and Grove Streets (Wagner 1979). The final collapse of the industry came with the flood of 1889 which critically damaged the canals, forcing them to close. Such events would have created demolition debris and flood deposits that would have accrued on the land surface before later stages of rebuilding occurred.

New and more diversified industries emerged in the twentieth century, including brick refractories, silk mills, and pulp and paper companies. The economy, which went into periods of recession towards the end of the nineteenth century, has since stabilized and has remained relatively vibrant throughout the twentieth century.

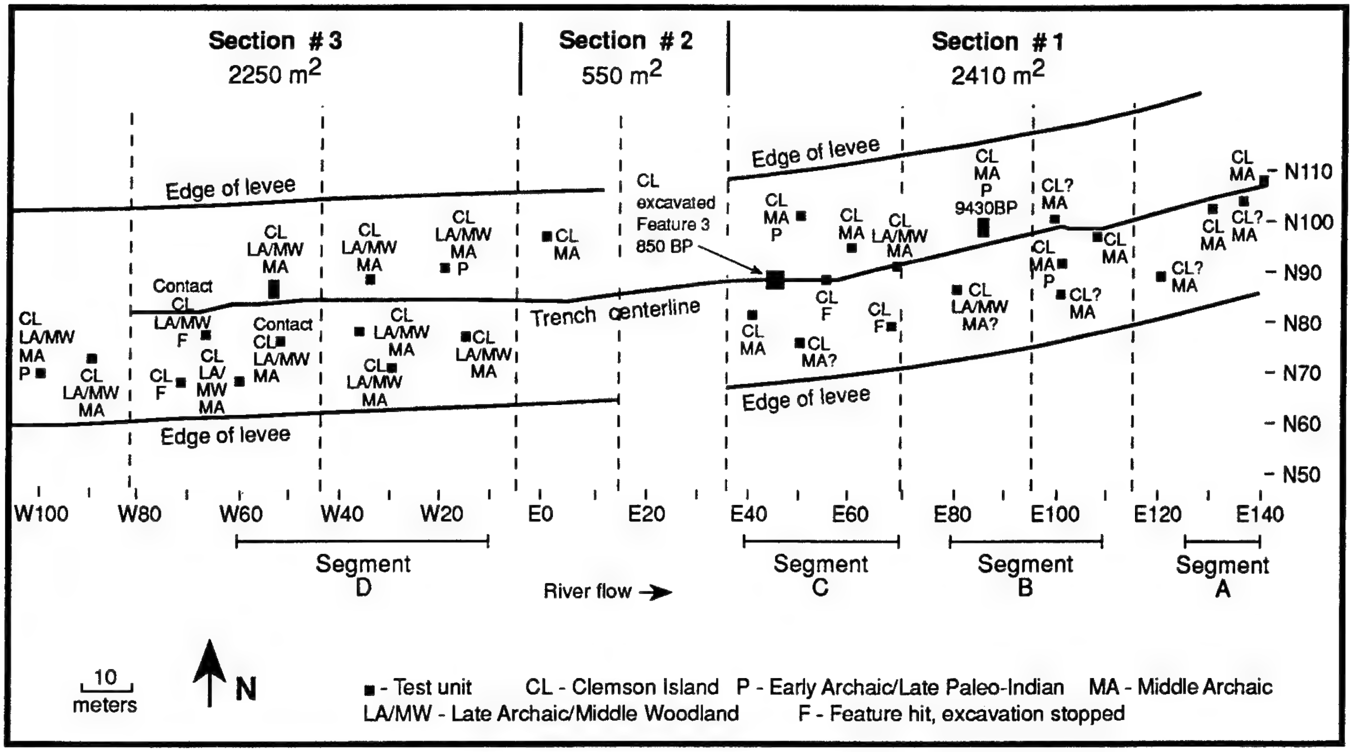
PREVIOUS RESEARCH

The following is a summary of previous research done at the West Water Street Site (36CN175), and is condensed from Watson, Bailey, and Custer (1992). In 1992, the University of Delaware Center for Archaeological Research (UDCAR) was contracted by Kise, Franks, and Straw in accordance with the scope of services issued by the Planning Division, Baltimore District, Army Corps of Engineers, to conduct a Phase I and II archaeological survey along the West Water Street reach of Lock Haven, Pennsylvania. During Phase I work, shovel test pit excavation and geomorphic corings were employed to ascertain the presence or absence of cultural materials and buried intact soil deposits. Phase I research indicated the presence of both historic and prehistoric cultural materials and the presence of buried intact soils across the entire study area.

During Phase II investigations, test unit and feature excavations, further geomorphic coring, and backhoe trenching were employed to determine the horizontal and vertical extent of the multiple prehistoric cultural deposits and the cultural affiliations and ages of the components and features. Also, natural soil deposits were analyzed in order to understand the depositional context of the cultural materials. Phase II excavations revealed five different prehistoric components in Sections 1 and 3: an eighteenth century contact period

FIGURE 4

Distribution of Prehistoric Components by Sections Showing Centerline and Edge of Levee



component, a Clemson Island component, a poorly represented Late Archaic/Middle Woodland component, a Middle Archaic component and an Early Archaic/Late Paleo-Indian component. Figure 4 shows the distributions of the various components within the sections and segments of the study area. No intact cultural components were identified in Section 2 due to heavy modern disruption. Figure 5 shows an idealized profile of the cultural and natural stratigraphy of the site.

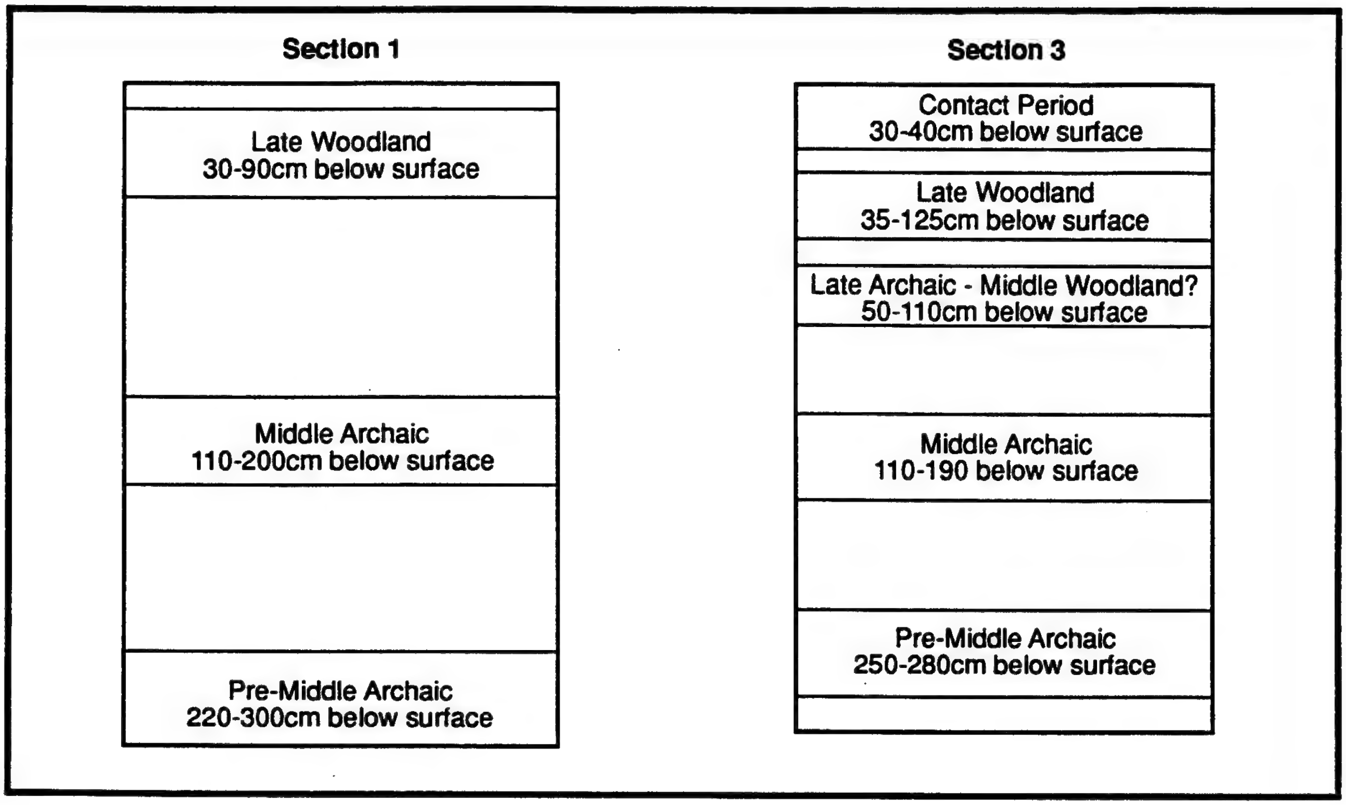
Late Archaic - Contact Period

The Contact Period component of the site was found only in Section 3 of the West Water Street Site (35CN175), (Figure 3). Artifacts recovered from this occupation included several glass trade beads, a Jew's harp, and cut brass kettle fragments. It appeared that these artifacts were from a buried A-horizon, and the potential for finding Contact-era living site features and burials was thought to be good.

A vast CLemson Island component was identified in all of Sections 1 and 3 (Figure 2). This occupation included several sub-surface hearth and storage/refuse features. It also appeared that in some areas the component was associated with a buried A-horizon, while in other places no clear paleosol was found. Artifacts found in association with this component include

FIGURE 5

Idealized Profile from Phase II Research



Clemson Island ceramic sherds, triangle projectile points, and lithic debitage. A storage/refuse pit excavated in Section 1 indicated excellent faunal preservation and yielded a radiocarbon date of A.D. 1100 $\pm$ 60, uncorrected (Beta 53663).

A Late Archaic/Middle Woodland component was identified mainly in Section 3 (Figure 3). This occupation was more poorly represented than the overlying Clemson Island and underlying Middle Archaic components. Only two Late Archaic/Middle Woodland projectile points were found during testing in Section 3. Again, the soils of this component appeared to indicate A/B-horizon development in some test units and not in others.

Middle Archaic Period

The Middle Archaic component of the West Water Street site was well represented in excellent stratagraphic context in numerous locations within Sections 1 and 3 (Figure 3). The presence of diagnostic Middle Archaic Neville/Stanly projectile points and the stratagraphic location of the buried components made the chronological placement of the component unequivocal. Middle Archaic artifacts, which included a large number of chert and jasper lithic debitage, were found in clear association with buried A-horizons. The wide distribution of these artifacts across the site suggested that there was substantial use of this

section of the Susquehanna River in the Middle Archaic times. The depth of the Middle Archaic component range from 120-170 cm below ground surface across the study area.

Early Archaic/Late Paleo-Indian Period

Evidence for an Early Archaic/Late Paleo-Indian occupation was found in several deep test units in Section 1 and 3 (Figure 3). As with the Middle Archaic stratum, artifacts were associated with an intact A-horizon. The depth of the Early Archaic/Late Paleo-Indian horizon ranged from approximately 220-300 cm below ground surface across the site. Artifacts recovered from this horizon included chert flakes and flake tools, and a chert late-stage biface. Although no diagnostic artifacts were found during Phase II testing, rich carbon deposits were identified and samples were collected for radio-carbon dating. The carbon returned a date of 7480 ± 310 B.C. (Beta 53664) which placed the horizon within the Early Archaic/Late Paleo-Indian Period.

Based on the presence of these varied cultural components in excellent stratigraphic context, the West Water Street Site was determined to be eligible for the National Register of Historic Places. Phase III excavations were then undertaken to mitigate the effects of the project on the site.

PHASE III RESEARCH DESIGN AND METHODS

Research Design

The following research design is generally based upon the state-wide research recommendations in Pennsylvania's **Comprehensive State Plan for the Conservation of Archaeological Resources** (Raiber 1985), the regional research design for the Ridge and Valley zone of Pennsylvania produced by Hatch, et al. (1985), the regional and local archaeological data summaries prepared for **Prehistoric Cultures of Eastern Pennsylvania** (Custer n.d.a) and **Man, Land, and Time** (Turnbaugh 1977), and specific archaeological overviews of relevant cultural complexes such as two recent studies of the Late Woodland Clemson Island Complex (Stewart 1990; Hay, Hatch, and Sutton 1987). The discussion of the research design is organized by the prehistoric archaeological components discovered during the Phase II research.

Before discussing the research questions appropriate to each of the components some general research issues and the research methods associated with each will be noted. Five basic research questions are applicable to all of the components, and most can be considered both synchronically (one point in time) as well as diachronically (change through time): (1) What types of lithic tool reduction activities were taking place at the site, and what lithic materials were being used? (2) Are activity areas present and definable at the site? What, if any, variability

TABLE 2

General Research Requirements and Methods

I. Determination of Types of Lithic Tool Reduction Activities

Field Research Requirement

- Recover sufficiently large sample of debitage, micro-debitage cores, and bifaces from varied components

Laboratory Analysis Methods

- Attribute analysis of debitage to determine lithic reduction activities (Lowery and Custer 1990; Gunn and Mahula 1977; Verrey 1986; Magne 1985)
- Analysis and classification of bifaces by reduction stages (Callahan 1979; Moeller 1980: 40-48)
- Analysis and classification of cores by shape, preparation, and flake removal sequence (Custer 1986a; Parry and Kelly 1986)
- Analysis of micro-debitage (Verrey 1986; Magne 1985; Custer n.d.)

II. Spatial Definition of Activity Areas and Community Patterns

Field Research Requirements

- Excavate sufficiently large contiguous areas to determine dispersed activities
- Excavate multiple contiguous areas throughout the site to sample variability of activities
- Flotation processing of constant volume samples from features and living surfaces

Laboratory Analysis Methods

- Identification of individual activity areas and assessment of their integrity by identification of debitage from individual cores and bifaces by colors, textures, and refits (Carr 1986; Custer, Stiner, and Watson 1983)
- Plotting of artifact distributions across site and activity areas using computerized mapping techniques (e.g. - Custer and Bachman 1982, 1986)
- Blood residue analyses after proper procedures for screening contaminants (Custer, Ilgenfritz, and Doms 1988)
- Determination of artifact functions using high and low magnification studies (e.g. - Ahler 1971; Custer and Bachman 1982)
- Analysis of feature form and content to ascertain function (e.g. - Stewart 1988; Custer and Bachman 1982)
- Analysis of ceramic functions using examination of vessel surface alteration (Hally 1983)

III. Refinement of Site Chronology

Field Research Requirements

- Recover organic samples from good contexts
- Maximize recovery of small diagnostic artifacts, such as beads from Contact component through use of flotation samples (see below)

Laboratory Analysis Methods

- Make special reference to detailed chronologies for beads (Kent 1984:211-222; 1983) and ceramics (e.g. - Stewart 1990: 85-89; Hay, Hatch, and Sutton 1987)

IV. Determination of Prehistoric Foodways and Diets

Field Research Requirements

- Use flotation methods to process constant volume samples from features and intact living surfaces
- Retain small-volume samples for pollen and phytolith analysis

TABLE 2 continued

General Research Requirements and Methods

IV. Determination of Prehistoric Foodways and Diets

Laboratory Analysis Methods
- Standard analysis of faunal remains from both flotation and standard excavations (e.g. - Webster `1984)
- Wood identification analysis (e.g. - McWeeney 1984; Stewart 1988:VI-103 - VI-104; Appendix I)
- Analysis of seed and charred plant food remains (e.g. - Moeller 1986)
- Analysis of pollen and phytolith remains, if present (e.g. - Dimbleby 1985; Piperno 1988; Carbone 1977)

V. Specialized Comparative Analyses of Other Sites

Field Research Requirements
- none

Laboratory Analysis Methods
- Comparison of tool assemblages with other sites using cumulative frequency curves and tool typology specified in Lowery and Custer (1990)
- Comparison of percentage counts of flake attribute distributions, raw material types, and tool types using difference of proportion tests and comparable data sets from regional sites (see Custer, Catts, Hodny, and Leithren 1990 for discussion of methods and review of data base)

between areas is apparent, and how does this variability reflect community patterning? (3) What is the chronology of the site? (4) What were the prehistoric foodways practiced at the site, and what role did various faunal and floral resources play in prehistoric diets? What role, if any, did agriculture play in Late Woodland occupations at the site? (5) How does the information present at the West Water Street Site compare to other sites both locally and regionally? Table 2 lists the general research topics associated with these questions, and their research requirements for fieldwork. A sample of the specific research methods is also included. These research topics will be noted during the discussion of the individual components. It is important to note that not all analyses will be possible due to limitations of data preservation and context.

Contact Component. The Contact component was represented in the Phase II research by a series of artifacts of European manufacture, including a jew's harp, glass and shell beads, and cut fragments of brass kettles. These artifacts are associated with Native American artifacts and are typical of the items traded to local Native American groups during the seventeenth and eighteenth centuries (Kent 1984). The beads found during the Phase II excavations, which have been shown to be sensitive and accurate indicators of the age of Contact Period sites (Kent 1983, 1984:211-222), date to the time period between 1700 and 1730.

In a compilation of documentary information on eighteenth century Contact Period sites Kent, Rice, and Ota (1981) note two potential sites in the Lock Haven area. One site is located on Great Island and is mentioned by Turnbaugh (1977:245) and Meginness (1889). This site is located several kilometers downstream of the project area, and cannot be correlated with the Contact Period artifact finds in the project area. The second site is known as "Dunnstown" and its exact location and the cultural affiliation of its inhabitants are unknown. Turnbaugh (1977:245) notes that mid-eighteenth century European artifacts have been found throughout the general Lock Haven area by local avocational artifact collectors and feels that this is the general date of the Dunnstown site. There is no way to specifically relate the Contact component of the study area with "Dunnstown;" however, the documentary and archaeological evidence indicates that numerous Native American groups, including the Shawnee, Lenape or Delaware, and Iroquois, were present in this section of the West Branch Valley during the eighteenth century. The Contact component in the project area is related to one or more of these groups.

Most Contact Period sites are known from burial contexts (Kent 1984) and few finds of eighteenth century Native American domestic sites are known. Because the Contact Period artifacts in the project area are derived from non-burial contexts they are of special interest. Furthermore, few Contact sites are known from the early portion of the eighteenth century and the only known example is the Lancaster County Park Site (Kinsey and Custer 1982). Therefore, the Contact component is especially unique and basic description of the component is a major research goal.

The excavation and description of the Contact component can be focused on the more specific research question of understanding the extent to which Native American lifeways had been altered through their interactions with Euroamerican populations. Archaeological data from the Lower Susquehanna Valley (Kent 1984) indicate that major alterations of Native American lifeways took place during the seventeenth century. Most eighteenth century Native American populations of Pennsylvania were refugees from throughout the Middle Atlantic region who were drawn to the colony by William Penn's rather liberal policies toward Native American populations (Jennings 1966). The goal of Penn and his proprietorship was to reestablish a fur trade to produce revenue; however, this trade did not materialize. Most Native American populations were caught in the middle of the French and English colonial conflicts, as well as the American Revolution, and left the area by the end of the eighteenth century. Thus, the Contact component probably represents the relatively short-term archaeological remains of a highly acculturated Native American group. A major research goal is to identify the signs of this acculturation in the material remains seen in the archaeological record.

The basic excavation and description of the Contact component included the excavation of a contiguous area and all of the general research issues and methods listed in Table 2 are applicable. A special goal was to identify any domestic structures or related processing and refuse features. During the seventeenth century, many Native American groups were still residing in traditional house forms such as longhouses (Kent 1984:354-357). By the middle portion of the eighteenth century, non-traditional cabin-like structures seem to have replaced the traditional house forms in the Lower Susquehanna Valley (Kent 1984:382-384). Because the Contact component falls between these two time periods, and is in a different area, it would be interesting to see how house forms, and family structures, were altered during the Contact Period. For example, many pre-Contact and early Contact Period house forms seem to be large communal dwellings for extended families while later Contact Period houses are the dwellings of individual nuclear families. This change in house form clearly shows a change in social structures and family organizations.

Excavation of refuse features was of special interest in order to collect food remains and understand changes in Native American diets during the Contact Period. Finally, collection of any artifacts of European manufacture in direct association with aboriginal artifacts was important to document the extent to which European technologies replaced traditional ones.

Clemson Island Component. The Clemson Island component is widely distributed throughout the study area and includes potential intact living surfaces and sub-surface hearth and storage/refuse features. The presence of these features clearly indicates that one or more domestic occupations are present; however, it is not clear if any of these occupations are contemporaneous. Although many research questions can be addressed through the study of the Clemson Island component, one of the most important is the study of development of settled village life in the Susquehanna Valley.

Archaeological data on the Middle Woodland cultures which preceded Clemson Island cultures in the West Branch Valley (ca. A.D. 0 - A.D. 800) are sparse (Turnbaugh 1977:195-229); however, it is clear that they probably were rather mobile and lived in non-sedentary base camps. Cultivated plant foods probably played little, if any, role in their diets. By A.D. 1300, however, local cultures were living in settled villages, some of which were stockaded (e.g. - Bressler 1980). These later groups also were using various cultivated plant foods as important components of their diets. Thus, during the intervening period of A.D. 800 to A.D. 1300, which is the time frame of the Clemson Island Complex, the lifeways of local Native American populations were significantly transformed in many ways (Custer 1986b). The study of these transformations is an important research topic for the local area and Pennsylvania in general.

TABLE 3

Summary Data - Community Pattern Development Model

Stage I - Individual Farmstead/Household Cluster. The basic residential and social unit is a nuclear family. The household cluster includes the house and features associated with daily maintenance activities such as food preparation (hearth/fire pits, storage/refuse pits, sheet middens). Ritual activities are also presumably family-based due to presence of burials in household settings. Examples: Blue Rock Site (Heisey and Witmer 1964), St. Anthony (Stewart 1988).

Stage 2 - Hamlet. This community consists of sets of household clusters. Each household cluster retains all the individualized activity areas indicating that communal activities were infrequent. Examples: Fisher Farm (Hatch 1980), most of the Clemson Island habitation sites described by Hay, Hatch, and Sutton (1987) and Stewart (1990).

Stage 3 - Fortified Hamlet/Agglutinated Village. The presence of a stockade of some kind defines the limits of this community pattern. Certain aspects of individualized household activities are still represented in feature distributions. However, communal work/storage areas and secondary midden refuse disposal areas are present indicating the beginnings of community integration. Examples: Airport II (Garrahan 1990), Ramm (Smith 1976).

Stage 4 - Communal Village. By this stage the communities have expanded in size to include hundreds of people. Some examples include up to 60 houses while Stages 1-3 generally include fewer than 10 houses. Communal activities are common through all aspects of daily life. Burials are still localized in households even though the presence of centralized special function indicates some kind of community-based socio-religious activities. Examples: Slackwater (Custer et al. 1993), Kauffman (Nass and Graybill 1991).

Stage 5 - Planned Village I. Planned villages differ from communal villages in that there is a regular, and seemingly planned, placement of houses and structures within the community. The presence of special function structures and household burials indicates levels of community integration of socio-religious activities comparable to that of Stage 4. Examples: Murry (Kinsey and Graybill 1971); Mohr (Gruber 1971).

Stage 6 - Planned Village II. These villages are the largest communities seen in the Pennsylvania archaeological record and supported populations of thousands of people. The absence of household burials and the presence of outlying cemeteries indicates community, or at least lineage, based integration of socio-religious activities. Examples: Strickler (Kent 1984:348-367); Washington Boro Village (Kent 1984:335-338).

Figures 6 and 7 and Table 3 summarize a potential evolutionary sequence of community development in Pennsylvania during Late Woodland times and Stages 1 - 3 pertain to the developments of the Clemson Island Complex time period. The major trend of Stages 1 - 3 is an increase in the number of nuclear families and domestic groups who comprised an individual community. The transition between Stages 2 and 3 is also characterized by the emergence of the communal organization of spatial use within the communities as indicated by construction of stockades, secondary deposition of domestic refuse in middens, and the emergence of specialized food production and storage areas. Remains of cultivated plant foods, such as corn, have been found in association with all three stages of community development indicating that the use of agriculture preceded the changes in community development.

FIGURE 6

Community Pattern Development Model - Part I

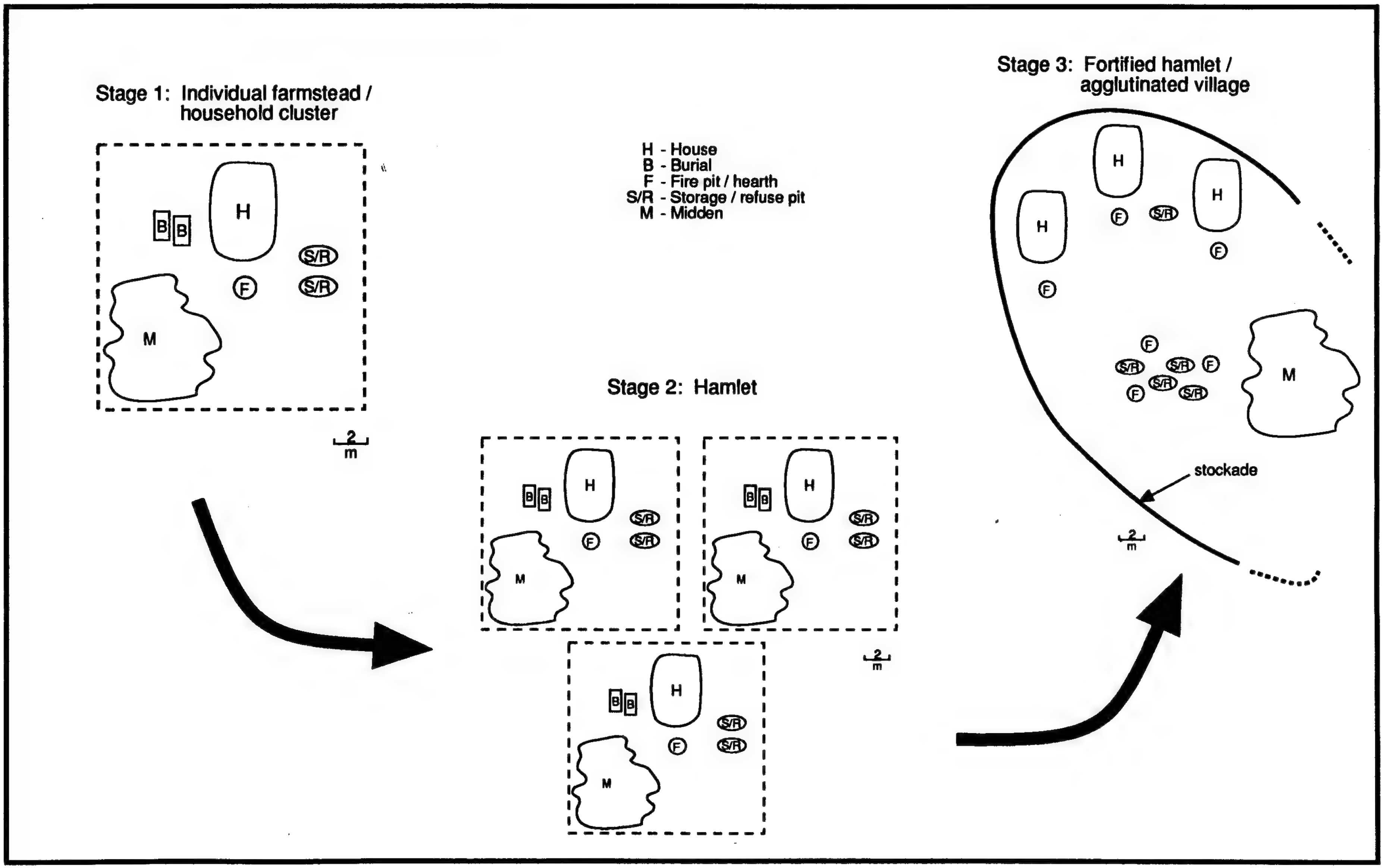
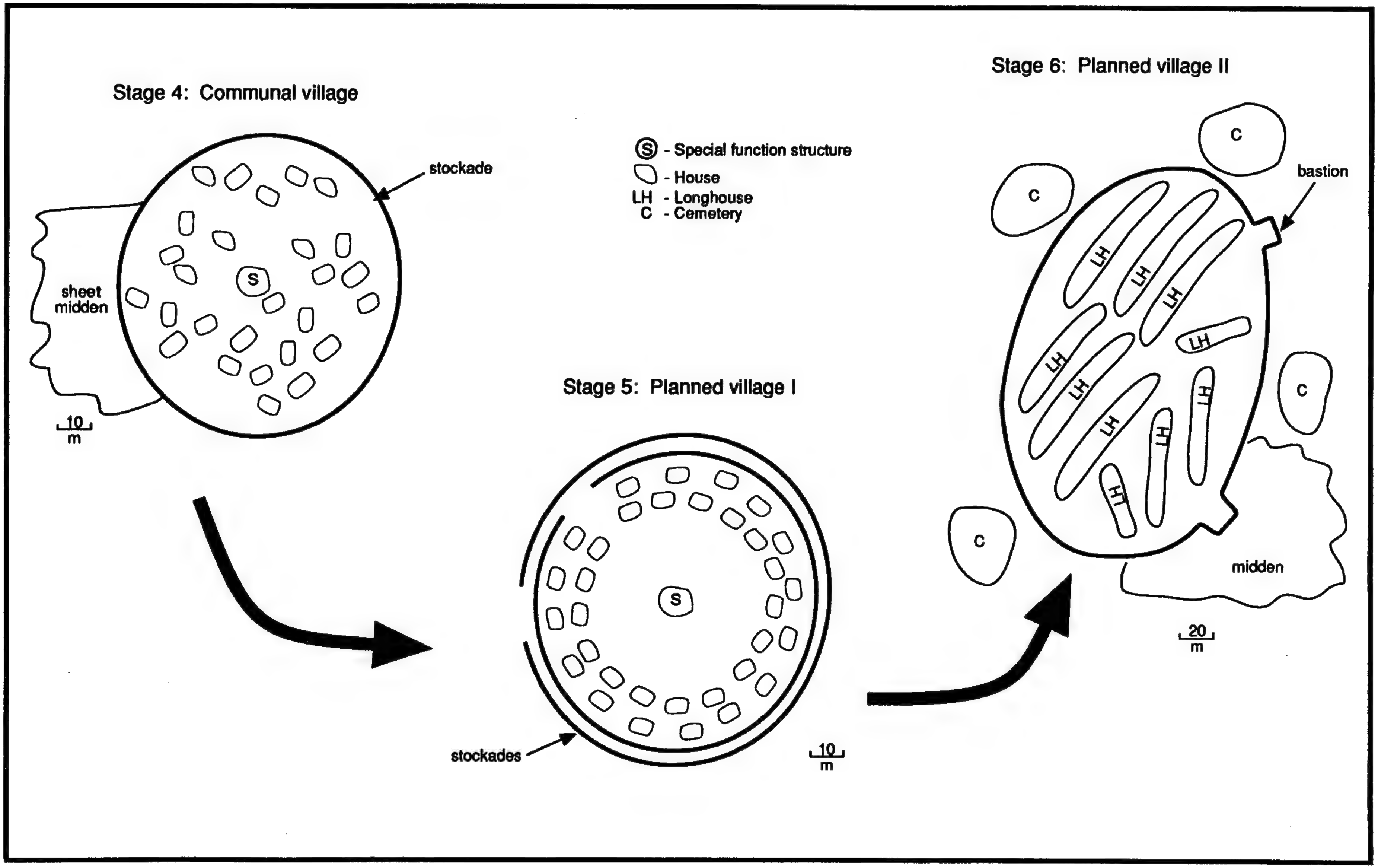


FIGURE 7

Community Pattern Development Model - Part II



The model presented in Figures 6 and 7 suggests that a clear-cut sequence of community development is known; however, numerous questions remain unanswered. For example, at any given time various examples from the developmental sequence may have coexisted (eg. - Hart 1993a). Some of the varied community types shown in the model may also represent seasonal residence variations of a single settlement pattern. The main point to note is that the model shown in Figures 6 and 7 outlines a series of general trends; however, the particular stages of the process of community pattern evolution are not well known. The data needed to better understand the particular processes are detailed descriptions of individual communities, especially descriptions which clearly identify contemporaneous household clusters and community patterning.

Excavation of the West Water Street Site focused on providing useful data for this research topic by exposing a large surface area of the Clemson Island component and identifying those features which can be linked together within a contemporaneous occupation. The relative spatial orientation of features of different functions, radiocarbon dates, chronological application of ceramic typologies, potential refitting of ceramic sherds among features, and other research methods noted in Topic II of Table 2 were all used to identify contemporaneous occupations. Once these data are gathered, they can be compared to other Clemson Island sites noted by Hay, Hatch, and Sutton (1987) and Stewart (1990) in light of the developmental model shown in Figures 6 and 7.

Excavations at the West Water Street Site also sought to gather data concerning of the role of agriculture in the community development sequence noted in Figures 6 and 7. There is a continuing debate in anthropology concerning the "causes" of the development of sedentary village life (Binford 1983). The traditional view is that the development of agriculture produces food surpluses which **allow** people to settle into sedentary village life (e.g. - Childe 1928; Braidwood and Willey 1962).

A more recent viewpoint suggests that groups first become sedentary due to population pressures, or other factors, and then **need** to adopt agriculture (MacNeish 1992; Flannery 1973; Binford 1983). The currently available Clemson Island Complex data clearly indicate that use of cultivated plant foods did indeed precede the development of village communities and these data would seem to support the traditional view noted above. However, the mere presence of cultigens does not tell us much about the role of cultivated plant foods relative to other food sources through the sequence of Clemson Island community development and such presence/absence data is not really useful in deciding which view of the role of agriculture in the development of sedentary communities is more accurate. Hatch (1980) has gathered data from the Fisher Farm Site, a small hamlet, which suggest that wild seed plants, such as **Amaranth** and **Chenopodium** were at least as important as cultivated plant foods. If wild plant foods were supporting the sedentary communities that developed during

the Clemson Island Complex, then the role of agriculture was not as important as the traditional viewpoints have suggested.

Initial excavations at the West Water Street Site showed that there is excellent preservation of charred plant food remains in the Clemson Island features. Excavation of additional features should yield more data on plant food remains and an important research goal will be to measure the relative importance of the varied types of food sources. The field and lab research methods listed for Topic IV in Table 2 will allow such data to be gathered and developed and will be applied to the Clemson Island component excavations. It should also be noted that a variety of analyses can be applied to any human remains encountered during the excavations in order to understand past food and diets. These analyses include studies of tooth wear and caries frequencies (Hinton 1981; Larsen 1983), and isotope and trace element analyses of bone chemistry (Price 1989). If human remains are encountered these methods will be applied where appropriate.

Basic descriptions of lithic and ceramic technologies will be part of the analyses of the artifacts from the Clemson Island component (see Topics I and II, Table 2). However, in addition to basic descriptions, the study of these technologies will be oriented toward the research questions noted above. For example, studies of ceramic vessel function based on vessel surface alterations (Hally 1983) can shed light on the kinds of cooking and storage activities that took place at the site. Large numbers of ceramic vessels with storage functions imply increased sedentism, and if large amounts of cultivated plant foods are also present, then agricultural production of seasonal food surfaces are very likely to have been part of Clemson Island settlement-subsistence systems. Organization of lithic tool kits and patterns of their production may also shed light on sedentism and occupation duration for the Clemson Island component (e.g. - Parry and Christenson 1987).

<u>Late Archaic - Middle Woodland Component</u>. This component is the most poorly known from the Phase II excavations at the West Water Street Site. Its age is uncertain; however, the shallow depth of the deposit and the presence of small stemmed points that have been found in Middle Woodland contexts elsewhere in the Middle Atlantic suggest a Middle Woodland age. Further definition of this component is a major research goal and all of the research topics and methods in Table 2 would be applied.

<u>Middle Archaic Component</u>. The Middle Archaic component of the West Water Street Site is well represented in excellent stratigraphic context at numerous locations within the site. The presence of diagnostic Middle Archaic Neville projectile points and the stratigraphic location of the buried components clearly make the chronological placement of the component unequivocal. Furthermore, the presence of additional artifacts including debitage and the rather wide distribution of Middle Archaic artifacts across the site suggest that there was substantial use

of this section of the Susquehanna River floodplain during Middle Archaic times.

In many ways, the Middle Archaic period (ca. 6500 - 3000 B.C.) is the most poorly known chronological period in Pennsylvania in particular and the Middle Atlantic region in general (Stewart 1991a; Custer n.d.a). A few components from this time period have been reported for the Delaware Valley (Stewart and Cavallo 1991); however, the Piney Island Site (Kent 1970) is the only other buried Middle Archaic component in the Susquehanna Valley of Pennsylvania. Some stratified components from this time period are known from New York sections of the Susquehanna Valley (Funk 1991), but these components are limited in size and have somewhat enigmatic dates (see discussion in Custer n.d.a).

Because Middle Archaic complexes are so poorly known within the region, basic description of these components at the West Water Street Site is a major research activity and all of the topics noted in Table 2 would apply. In fact, there are so few data concerning the Middle Archaic period that it is difficult to describe detailed research issues. However, recent syntheses of Middle Archaic data (Stewart 1991a; Custer 1990, n.d.a) do suggest some possibilities.

One potential research issue involves the nature of Middle Archaic community patterns and social organizations. The limited amount of data from Middle Archaic sites in the region indicate that Middle Archaic populations were organized mainly into small groups composed of nuclear families who lived a rather mobile lifestyle. Most Middle Archaic sites are small campsites and they tend to be quite similar in their appearance (Stewart and Cavallo 1991). These similarities suggest that the individual nuclear-family based groups followed a relatively consistent set of subsistence and tool producing activities as they wandered through the oak-hemlock forests that characterized this region during Middle Archaic times (Custer 1990:6-13). This kind of conservative mobile hunting and gathering lifestyle is similar to that observed for the Algonkian groups of eastern Canada and is an effective adaptation to dense mixed coniferous/deciduous forests (Custer and Stewart 1990; Custer 1990:14-20).

Some interaction between the individual family groups would be necessary if only to prevent inbreeding of the populations. Interaction between groups is also indicated by data that suggest the exchange of certain lithic raw materials between groups during this time period (Stewart 1991a). Furthermore there is a wide distribution of certain distinctive projectile point types, such as the Neville points found in the project area, which suggest that ideas about projectile points styles were transferred between groups. However, there are no known archaeological examples of large camp sites where these interactions might have taken place. It is possible that inter-group interactions may have taken place at small sites on an individualized basis rather than at large sites. On the other

hand, the sample of known Middle Archaic sites is so small, and the amount of area excavated at these sites is so small, that it may be possible that large Middle Archaic sites exist, but have not yet been found. Floodplain environments would have been especially attractive settings for larger sites during Middle Archaic times; however, Middle Archaic sites in these settings would have been deeply buried by sediments and are very difficult to find.

The Middle Archaic component at West Water Street is rather large, and deeply buried, and could possibly be one of the large sites noted above. The wide distribution of the Middle Archaic component across the site implies multiple occupations; however, these multiple occupations could have been caused by intermittent occupation of the site by small groups over a long period of time, or by the contemporaneous occupation of the site by numerous Middle Archaic social groups. In order to resolve this issue a fairly large contiguous area of the Middle Archaic component was targeted for excavation and the research methods of Topic II in Table 2 were applied.

An additional research issue for the Middle Archaic component at West Water Street is the study of the organization of stone tool kits. Middle Archaic tool kits differ from earlier tool kits in that ground stone tools for processing plant foods are first introduced into tool kits at this time. The appearance of ground stone tools is believed to be linked to the increased use of plant foods in local diets. If any food remains are preserved at the West Water Street site, they will be analyzed using the methods described in Topic IV in Table 2 and their analysis will be linked to the study of the use of any ground stone tools that may be discovered.

Middle Archaic chipped stone tool kits and production methods also seem to be less formalized than earlier examples (Custer 1990, n.d.a). However, detailed comparisons of Middle Archaic stone tool and debitage assemblages with those of other time periods have not been undertaken because of the paucity of Middle Archaic data. Middle Archaic chipped stone tool and debitage assemblages recovered from the Phase III excavations were formally compared to older and younger assemblages to assess similarities and differences using the methods and data bases noted in Topic V in Table 2. Tracing of potential lithic sources using chemical testing methods was attempted for samples from the Clemson Island, Middle Archaic, and Paleo-Indian/Early Archaic components. A cooperative endeavor with Penn State University was planned, but constraints on time and availability of research facilities made it impossible to undertake this research at the present time.

<u>Paleo-Indian/Early Archaic Component</u>. Paleo-Indian/Early Archaic cultures are somewhat better known than those of the Middle Archaic. However, much needs to be learned about these earliest inhabitants of Pennsylvania.

Abundant organic remains including bone, were present within the soil matrix of the Paleo-Indian component and there is a strong possibility that additional excavations will produce preserved foods remains. There are several varied views of the subsistence systems of Paleo-Indian/Early Archaic groups (see discussion in Custer and Stewart 1990). While some researchers see Paleo-Indian/Early Archaic groups as specialized hunters of big game such as caribou and mammoth, others see them as more generalized forages using any food resources that they could obtain. Unfortunately, very few of these views are based on firm archaeological data. The recovery and identification of food remains using the methods noted In Topic IV, Table 2 will generate the data needed to resolve some of these questions.

The research questions relating to Middle Archaic social organization and community patterning also apply to the Paleo-Indian/Early Archaic components and the same research methods would be used. Likewise, the issues regarding Middle Archaic chipped stone tool technologies would apply to the Paleo-Indian/Early Archaic components and the same research methods would be used here also.

Alluvial Geomorphology and Paleoenvironments. A final research topic that can be addressed using the data from the West Water Street Site is not related to any particular cultural component and uses chronological data derived from all of the cultural components. Numerous studies have tried to link the processes of past alluvial sedimentation and erosion with past climates (e.g . - Vento and Rollins 1989; Stewart 1991b). The most current and most reliable of these studies is recent work applying the concepts of genetic stratigraphy (Vento and Rollins 1989). This method seeks to correlate buried soil horizons (paleosols) with specific changes in past climates and environments. Studies of sedimentation rates are also a part of this research. Archaeological sites provide important data for these studies in that archaeological excavations in floodplain settings identify buried living surfaces and landscapes. The presence of diagnostic artifacts and radiocarbon dates from archaeological features also allows the precise dating of these ancient landscapes. The soil stratigraphy, the presence of buried landscapes and paleosols, and the preliminary dating of the cultural horizons at the West Water Street Site all provide important data for genetic stratigraphic studies. Further excavations and application of methods of Topic III in Table 2 will yield even more refined data on buried landscapes for the genetic stratigraphic studies. In turn, the insights about past climates and environments developed from genetic-stratigraphy studies will allow a better understanding of the environments to which prehistoric groups had to adapt.

Excavation Strategy

The excavation strategy presented below describes the specific field methods that were used to gather archaeological data needed to address the general research issues noted in the

research design and the specific research methods and data requirements noted in Table 2. General field and laboratory methods that are applicable to all of the components are discussed first.

Mechanically exposed living surfaces were excavated with shovels and trowels, and these surfaces were carefully troweled and flat shoveled to identify features. Trowels and other tools suitable for delicate excavation techniques were used on all features and fragile remains. The metric site grid, established during Phase II investigations, was reestablished at the site. This grid was shot in with a surveyor's transit. Ground surface elevations were also taken with a transit, and line levels were used to record the vertical location of cultural horizons. Complete field records, including daily field notes, level records, plan view maps, profiles, and feature drawings were also taken.

All soils were screened through 1/4 inch screen mesh hardware, and standard flotation and soil samples were taken from all features and interesting soils. A 2-liter flotation/water screen sample was taken from features and their internal provenience units, where appropriate, for flotation samples. Standard sample splitting methods were used to extract small samples for blood residue background contamination analysis, phytolith analysis, pollen analysis, and sample archives.

Laboratory methods for materials recovered from data recovery operations followed standard procedures. All stone tools and a sample of debitage were tested for the presence of blood residues using protocols established by the University of Delaware Center for Archaeological Research (Custer, Ilgenfritz, and Doms 1988). Unfortunately, no positive reactions were noted on any of the artifacts tested. All artifacts were washed and marked, and were cataloged according to standards established by the Pennsylvania Historic and Museum Commission. Flotation samples were processed using a water driven flotation tank which recovers heavy and light fractions. All information was then entered into a computer data base for analysis. Floral and faunal analysis was conducted at the University of Delaware using established type collections.

Data recovery excavations were focused on Sections 1 and 3 of the Central Site Area (Figures 2 and 3). Data recovery excavations consisted of two tasks. Task 1 consisted of excavation of the shallow Contact Period and Clemson Island components in Sections 1 and 3 of the Central Area of the site. Task 2 consisted of excavation of a sample of the buried Late Archaic - Middle Woodland, Middle Archaic, and Paleo-Indian/ Early Archaic components in the same area.

Task 1. This task focused on the investigation of the Contact Period and Clemson Island components within the "footprint" of the levee in Sections 1 and 3 (Figure 4). Historic fill overlying these components, which ranged in depth

FIGURE 8

Vertical Extent of Exploration Trench Impact - Section 1

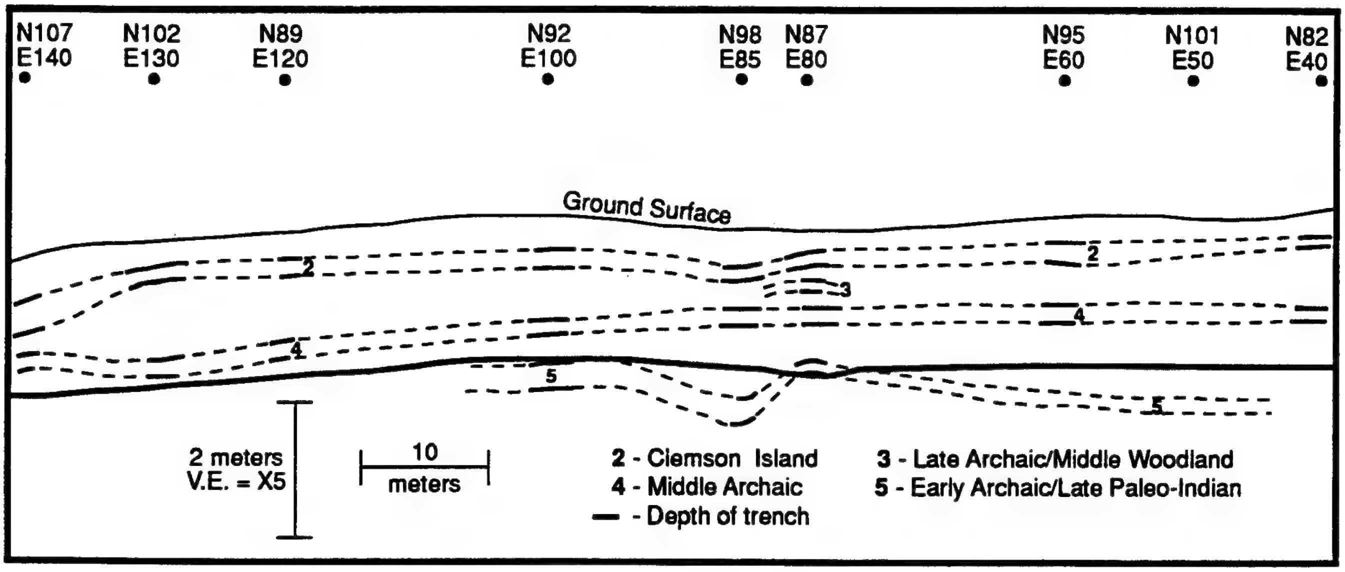
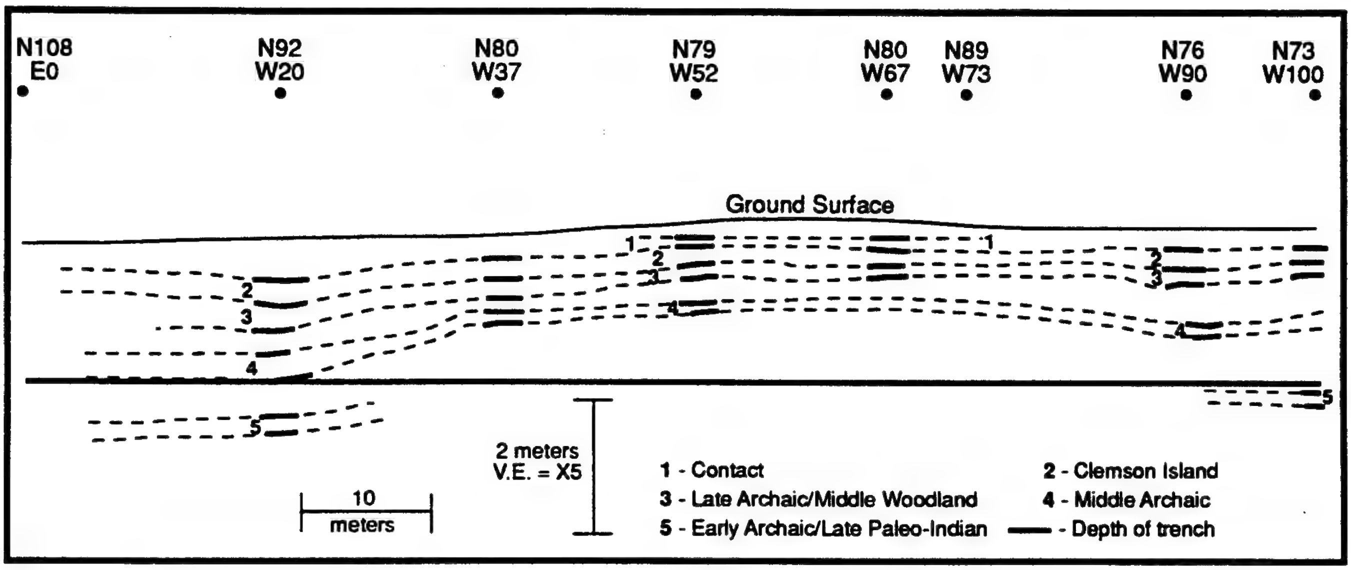


FIGURE 9

Vertical Extent of Exploration Trench Impact - Section 3



between .3 and .7 m, was removed using an excavator with a toothless bucket. The excavating machine did not traverse the site surface after the fill was removed. Instead, the machine sat on the unexcavated fill area, reached into the site area, and removed the overburden by pulling the soils back toward itself. This method minimized the damage to archaeological deposits by keeping the excavator from traversing the site and allowed the maximum precision of the mechanical excavation. An archaeological excavation supervisor continually monitored the mechanical excavation process and made sure that damage to archaeological deposits did not occur.

Phase II excavations showed that some limited living surfaces from the Contact and Clemson Island components were preserved. These surfaces were excavated in 10 cm levels with a minimum provenience unit of a 50 cm block within a 1 m square after the removal of the overlying fill. All exposed cultural features, exclusive of post molds, were excavated using appropriate levels which were arbitrary, natural, cultural, or a combination thereof given the stratigraphic context of the internal feature deposits. A sample of post molds was excavated and cross-sectioned. Two liter soil samples for flotation were taken from one 50 cm block per 2 m x 2 m area. All other soils from feature contexts and living surfaces were screened through 1/4 inch mesh hardware cloth.

<u>Task 2.</u> This task was intended to mitigate the effects of the exploration trench by sampling of the buried archaeological deposits in Sections 1 and 3 of the Central Site Area. Figures 8 and 9 show the vertical extent of the impact of the inspection trench upon archaeological deposits in these sections. Only a sample of the buried deposits was excavated. Figure 4 shows the segments of the exploration trench that were subjected to data recovery excavations and Table 4 provides information on the size of the segments, their grid locations, and the components present in each. These segments were chosen for data recovery excavations because they were shown to contain intact deeply buried archaeological deposits during the Phase II excavations. Table 5 lists the approximate size of the block areas that were excavated for each in each segment (the actual dimensions of these blocks varied somewhat depending on the existence and location of buried features).

Phase II excavations had shown that the deeply buried components are separated by layers of culturally sterile soils which range in thickness between .5 and 1.0 m. These soils were removed using an excavator with a toothless bucket. As was the case for the mechanical stripping of the shallow deposits, the excavating machine did not traverse the site surface after the sterile soils had been removed.

Buried living surfaces within the excavation blocks were excavated in 10 cm levels with a minimum provenience unit of a 50 cm block within a 1 m excavation square after the removal of the overlying fill. All exposed cultural features were excavated

TABLE 4
Trench Segments and Buried Components

Segment	University of Delaware Grid Location	Length	Segment	Component Depth
A	E140-E125	15 meters	Middle Archaic	1.0 meters
B	E110-E80	30 meters	Middle Archaic	1.0 meters
			Paleo-Indian/Early Archaic	1.0 meters
C	E70-E40	30 meters	Middle Archaic	1.0 meters
			Paleo-Indian/Early Archaic	1.0 meters
D	W10-W60	50 meters	Late Archaic-Middle Woodland	0.5 meters
			Middle Archaic	0.7 meters

TABLE 5
Excavation Block Allocations

Segment	Component	Excavation Block Size	Overburden Depth	Volume
A	Middle Archaic	10 meters x 10 meters	1.0 meters	100 cubic meters
B	Middle Archaic	10 meters x 10 meters	1.0 meters	100 cubic meters
	Paleo-Indian/Early Archaic	5 meters x 10 meters	1.0 meters	50 cubic meters
C	Middle Archaic	10 meters x 10 meters	1.0 meters	100 cubic meters
	Paleo-Indian/Early Archaic	5 meters x 10 meters	1.0 meters	50 cubic meters
D	Late Archaic-Middle Woodland	20 meters x 10 meters	0.5 meters	100 cubic meters
	Middle Archaic	20 meters x 10 meters	0.7 meters	140 cubic meters

using appropriate levels which were arbitrary, natural, cultural, or a combination thereof given the stratigraphic context of the internal feature deposits. Vertical control was maintained through level lines referenced to a permanent datum bench mark through use of standard surveying instruments. Two liter soil samples for flotation were taken from one 50 cm block per 2 m x 2 m area. All other soils from feature contexts and living surfaces were screened through 1/4 inch mesh hardware cloth.

In two instances, prehistoric human remains were found during the excavations. In each case, UDCAR staff immediately contacted the Corps of Engineers (COE), Baltimore District, Planning Division Staff. The COE then began the development of a treatment plan which was in full compliance with the Native American Graves Protection and Repatriation Act (NAGPRA). As the lead agency, the COE had the responsibility to comply with NAGPRA which involved such actions as publication in the Federal Register, consultation with appropriate Native American groups, determination of possible scientific study, resolution of competing claims and repatriation. The responsibility of the COE under Section 106 of the National Historic Preservation Act, the implementing regulations, and the Memorandum of Agreement in place for the project did not in any way alter the responsibility of the COE under NAGPRA.

At the earliest possible time, the COE provided available information on the discovery of human remains to both the Pennsylvania SHPO and the Advisory Council on Historic Preservation (ACHP). The COE requested the comments and recommendations of the Pennsylvania SHPO and the ACHP in

developing an appropriate treatment plan for the remains. The remains were of Native American descent, therefore simultaneous with the coordination with the Pennsylvania SHPO and the ACHP, the Planning Division consulted with appropriate Native American groups regarding the discovery of the human remains and the development of the treatment plan.

SITE STRATIGRAPHY

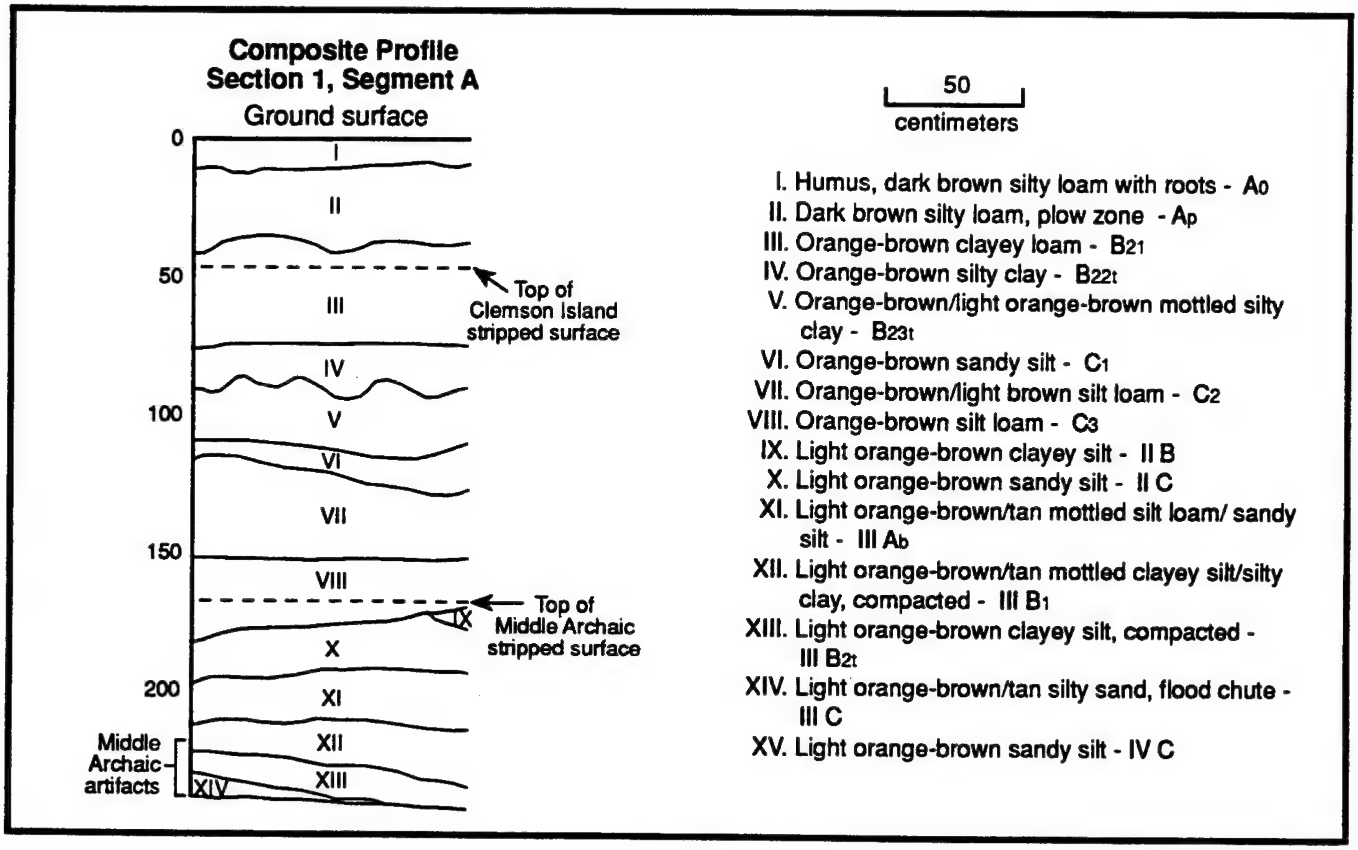
The following section of this report discusses the cultural and natural stratigraphy of the West Water Street Site. The main goal of the description is to establish the contextual integrity of the archaeological deposits. An additional related goal is to develop an understanding of the episodes of soil deposition and soil horizon development at the site. Data on soil deposition and horizon development processes can yield important insights about the environments and climates within which prehistoric people lived (e.g. - Vento and Rollins 1989; Stewart 1983; 1991) and these data will also be described here.

The soils in Sections I and III, Segments A, B, C, and D, are discussed separately. A composite profile showing the general sequence of soils in each of these four areas is presented first. More detailed profiles of buried soils with descriptions of associated prehistoric artifacts are also presented. In general, the artifact-bearing soils in each area of the site contained the same cultural occupations, in the same relative stratigraphic setting, that were identified during the Phase II testing (Figure 5). The discussion of the dated archaeological components in this section only notes the diagnostic artifacts in a cursory way to provide dated reference points for the correlation of profiles. More detailed analyses of the chronology of the diagnostic artifacts are presented later. Dates for diagnostic artifacts used here are taken from overviews by Turnbaugh (1977) and Custer (n.d.a). Figure 3 shows the location of the Sections and Segments of the West Water Street Site and composite profiles illustrating the general soil sequence for each Section/Segment are shown in Figures 10-13.

The conventions for descriptions of the varied soil horizons are taken from standard soil profile nomenclature as described by Birkeland (1974) and as applied to archaeological profiles by Foss (1977). Some modifications to the nomenclature used by Vento and Rollins (1989) are also included. A special effort was made to use the standard soil horizon sequence nomenclature to recognize individual deposition units separated by discontinuities within the site's profiles. In some cases the discontinuities were buried A-horizons with underlying B and C horizons and were true paleosols. In other cases the paleosols had been truncated or eroded beneath the discontinuities so that only the illuviated B-horizons remained. Nonetheless, the recognition of depositional units that could be correlated across the site via the use of dated diagnostic artifacts allowed for a definition of chronostratigraphic units.

FIGURE 10

Composite Profile of Segment A



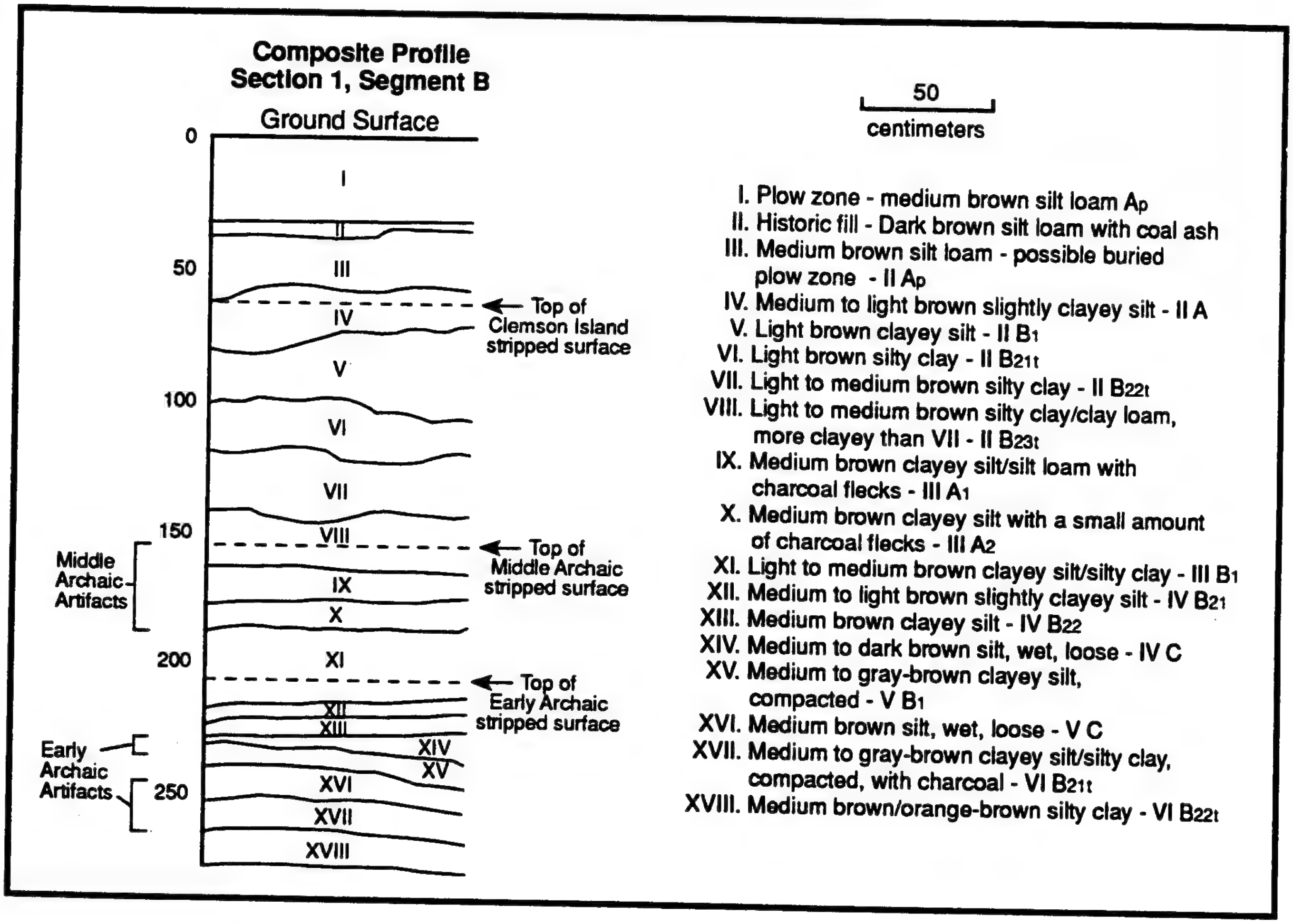
Segment A

Figure 10 shows the composite profile from Section I/Segment A and the levels with cultural deposits are noted. Three main depositional units are present. The top depositional unit consists of Soils I - VIII. The uppermost soil (Soil I) is a recent humus surface soil which was underlain by a historic plow zone (Soil II). Pit features containing a mix of Clemson Island Complex artifacts dating to ca. A.D. 800 - 1200 were encountered intruding into Soil III, a cambic B horizon with some incipient signs of pedogenic development. No artifacts were found in Soil III outside of the intrusive Clemson Island features. These pit features also contained Susquehanna broadspears which could date as early as 1500 B.C. The presence of these older artifacts in the later Clemson Island features indicates that there were land surfaces within Soil II that were occupied as early as 1500 B.C. Artifacts from these earlier occupations were then mixed among the soils that filled the later Clemson pits. Thus, the maximum age of Soil II is ca. 3500 years.

The remainder of the top depositional unit consists of Soils IV - VIII. Soils IV and V are argillic B horizons with varied

FIGURE 11

Composite Profile of Segment B

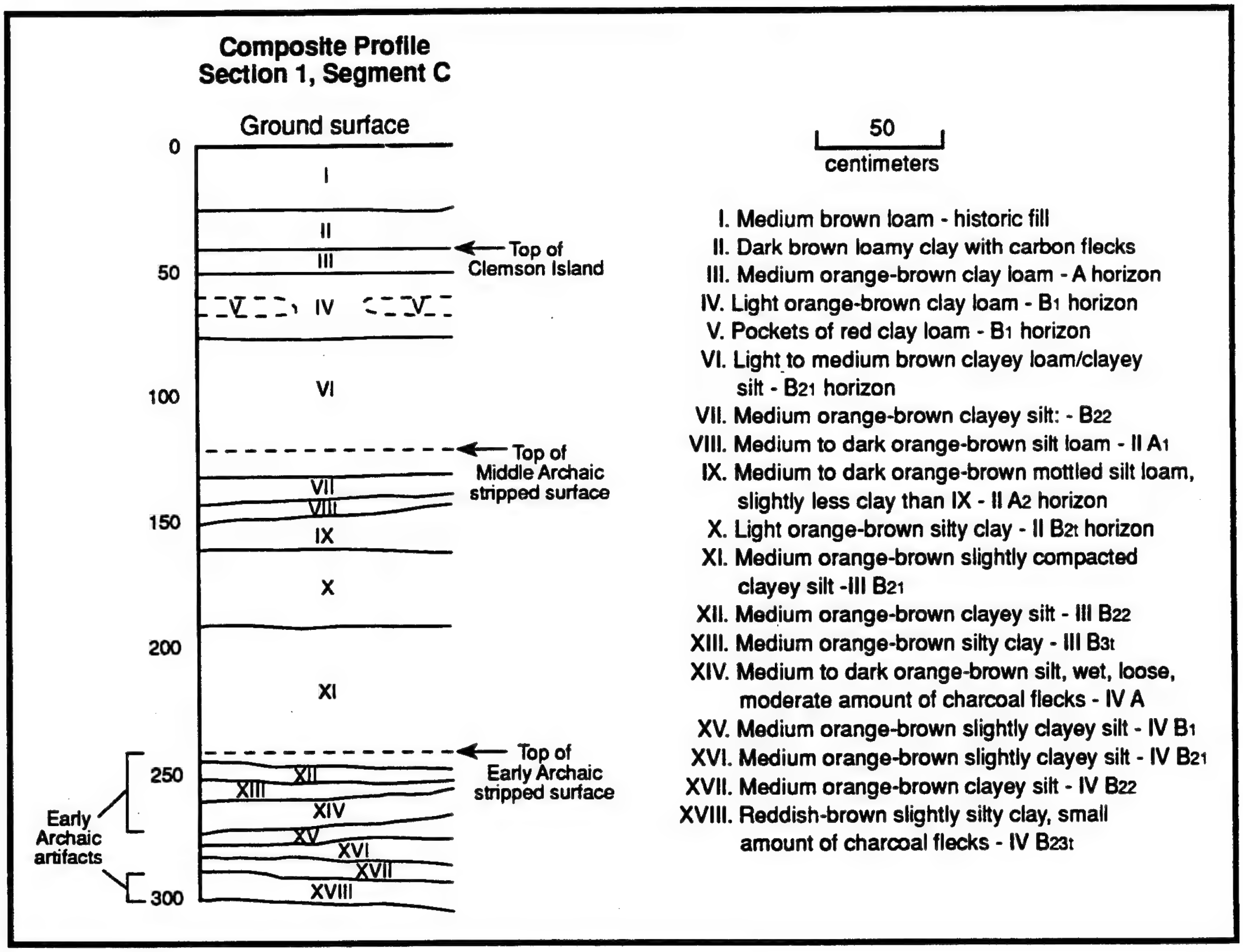


degrees of pedogenic development. Soils VI - VIII are C horizons representing a series of alluvial depositional events. Even though pedogenic development had not occurred in these C horizons it was not possible to determine the number or frequency of the depositional events that deposited these soils. However, it can be noted that the presence of the argillic B horizons (Soils IV and V) indicates that this depositional unit had considerable stability and probably did not result from the slow incremental deposition of thin soil deposits through time. Such deposition would not allow for the overall profile continuity needed to allow the pedogenic development of the argillic horizons.

Soil IX marks the top of the second depositional unit and is a poorly developed B horizon. Soil X is a C horizon similar to those noted in the first depositional unit. No artifacts were recovered from these soils. The absence of an A horizon in this unit shows that it was eroded and truncated, and the absence of a well-developed B horizon indicates that it was not sufficiently stable for pedogenic development to occur.

FIGURE 12

Composite Profile of Segment C



The third depositional unit begins with Soil XI which is a buried A horizon. No artifacts were recovered from this horizon; however, numerous artifacts were recovered from Soils XII - XIV. Figure 14 shows a detailed profile of Soils VIII - XIV. Soils XII and XIII are well-developed B-horizons and Soil XIV is a coarse textured C horizon which may be a flood chute deposit. The artifacts found in Soils XII - XIV included bifurcate points which date to ca. 6800 - 6000 B.C. The high degree of pedogenic development of these soils is consistent with the age of more than 8000 years indicated by the artifacts. No deeper excavations were undertaken in this area of the site.

In sum, the profile of Segment A shows three main depositional units. The uppermost horizons of the top depositional unit have a maximum age of 3500 years based on the presence of Susquehanna broadspears. The presence of these artifacts in later Clemson Island features indicates that the

FIGURE 13

Composite Profile of Segment D

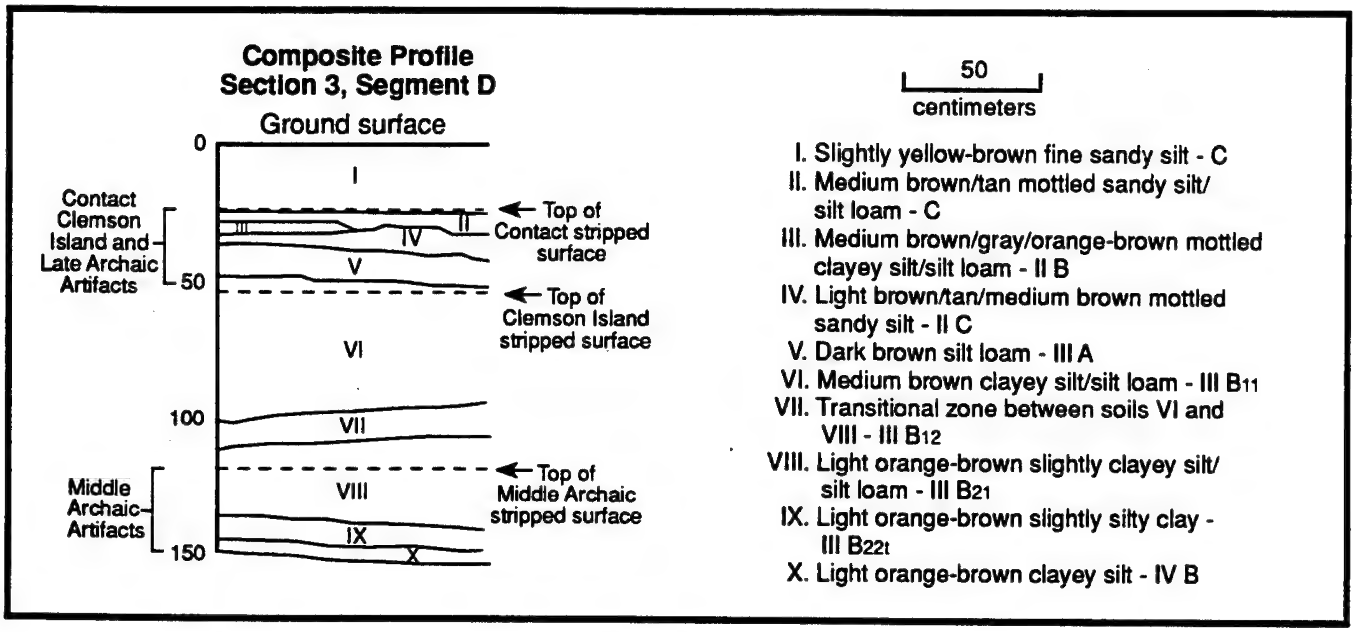
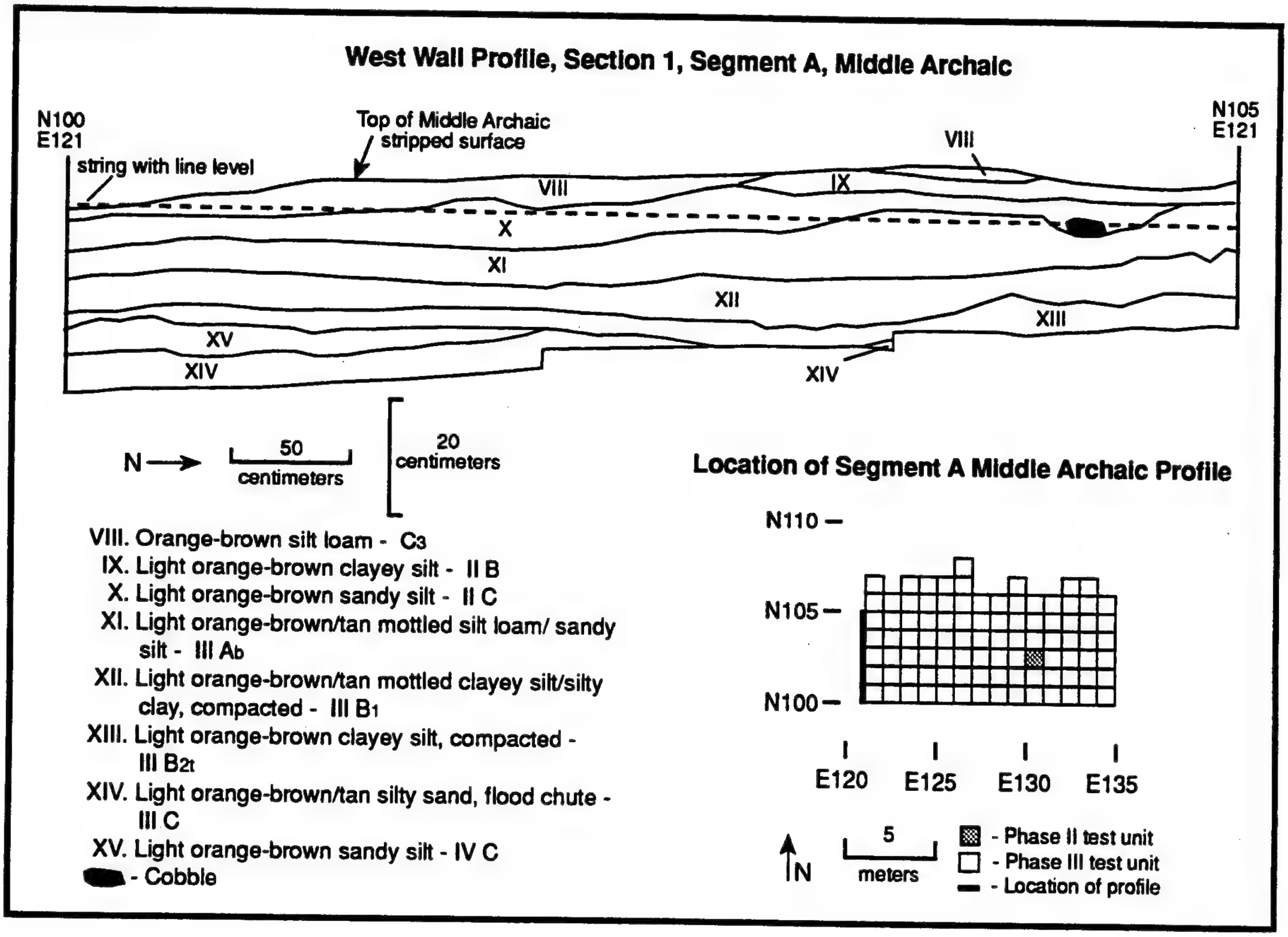


FIGURE 14

West Wall Profile of the Middle Archaic Component of Segment A



uppermost landscape was probably a stable surface for occupation for almost 3000 years. The presence of well developed B-horizons in this unit indicates that it was stable for a long period of time and may well have been deposited over a relatively short period of time. The second depositional unit is of an unknown age, but must be more than 3500 years old and less than 8000 years old based on the ages of the overlying and underlying deposits. This unit shows signs of erosion, truncation, and little pedogenic stability. The third, and oldest, depositional unit is approximately 8500 years old and shows signs of strong profile development indicative of significant profile stability and a short time frame of soil deposition.

Segment B

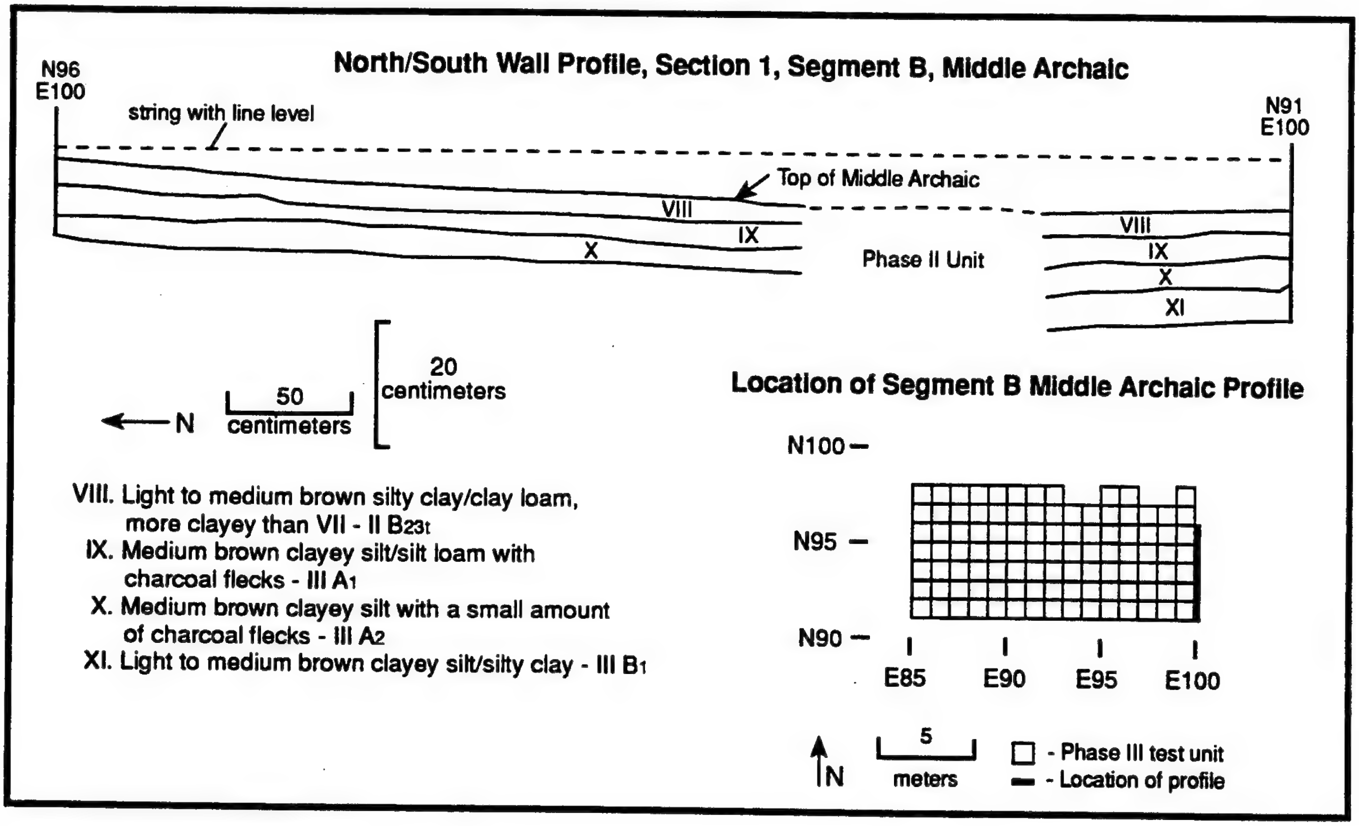
Figure 11 shows the composite profile of Section I/Segment B. Six major depositional units are present. A modern plow zone (Soil I) underlain by a thin layer of historic fill deposits (Soil II) comprise the top depositional unit.

The second depositional unit includes Soils III - VIII. The uppermost soil of this depositional unit consists of a buried plow zone (Soil III) underlain by another A horizon (Soil IV). A series of prehistoric archaeological features containing artifacts associated with the Clemson Island Complex and Susquehanna broadspears originate in Soil III and intrude into Soil IV. The associations of Late Woodland Clemson Island artifacts, dating to ca. A.D. 800 - 1200, and Susquehanna broadspears, which date to ca. 1500 - 1200 B.C., within the same features are similar to those seen in Segment A. This association indicates that the A horizons in the second depositional unit of Segment B were open and stable land surfaces upon which prehistoric people lived, and through which they excavated pit features for more than 2500 years. Considerable mixing of the varied archaeological deposits occurred during this time period and the older broadspears were included as part of the fill of younger Clemson Island features. The remainder of the second depositional unit consists of a poorly developed cambic B horizon (Soil V) which is underlain by three well-developed argillic B horizons (Soils VI - VIII). None of these horizons contained any artifacts. The extensive development of these argillic horizons indicates a great deal of profile stability and this profile stability is consistent with the surface stability revealed in the upper horizons of the depositional unit. The long-term stability shown by the presence of the extensive argillic horizons also implies that the unit was deposited over a limited period of time.

The third depositional unit includes Soils IX - XI. Artifacts were found in Soils IX and X and included projectile points that correspond to Neville (Dincauze 1976) and Stanly (Coe 1964) types dating to ca. 6500 - 5000 B.C. Soils IX and X are buried A horizons that contained small fragments of charcoal and other organic materials. A charcoal sample from Soil IX was

FIGURE 15

North/South Profile of the Middle Archaic Component of Segment B



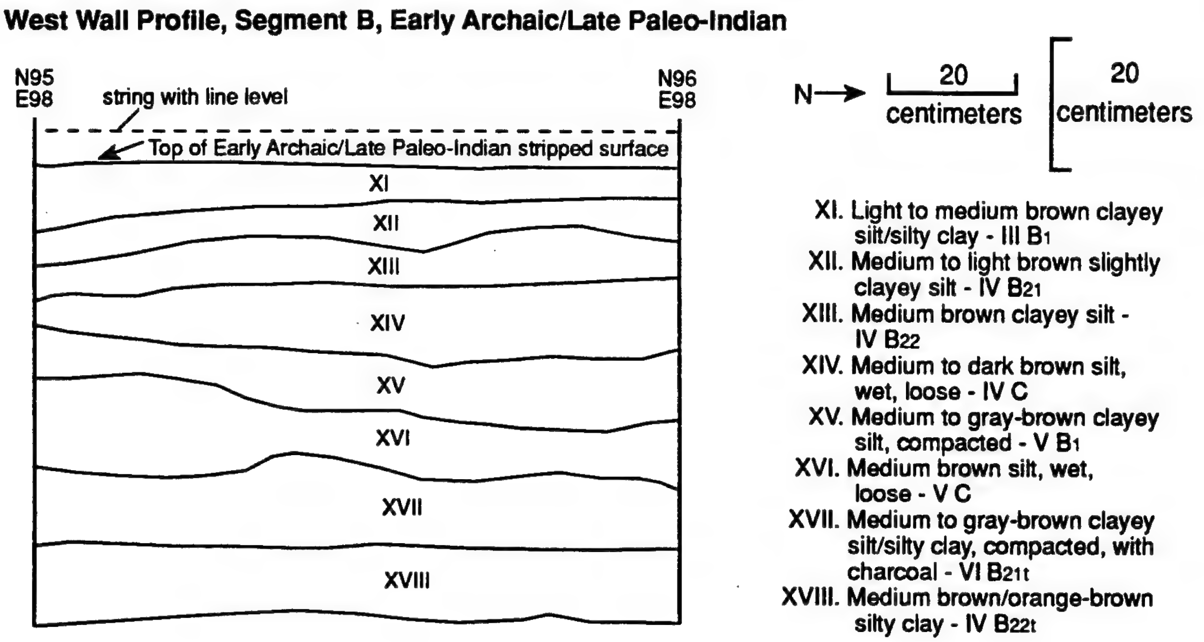
submitted for radiocarbon analysis and returned a date of 7390 ± 110 B.P., uncorrected (Beta-63528). Soil XI, which contained no artifacts is a poorly developed B horizon. Figure 15 shows a detailed 5 m long profile of the Middle Archaic occupation Page levels in Segment B. The limited range of diagnostic artifact types seen in the buried A horizons of this depositional unit and the poorly developed B horizons indicate that the entire unit is not the result of long-term profile and surface soil stability. Preservation of the buried organic deposits in this soil also indicates that its initial burial was rather rapid.

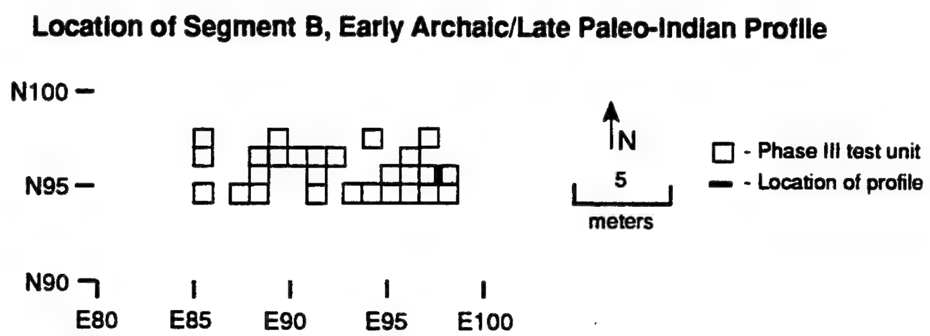
Soils XII - XIV comprise the fourth depositional unit. Soils XII and XIII are both well developed B horizons and Soil XIV consists of a relatively unweathered silty parent material. Artifacts were recovered from Soil XIV; however, no diagnostic artifacts were included in the assemblage. Based on the stratigraphic position of these artifacts beneath the overlying Middle Archaic component, the most that can be said is that the artifacts in Soil XIV probably predate 6500 B.C. Both Soils XII and XIII are moderately well-developed B-horizons, but do not show significant signs of pedogenic stability. Figure 16 shows a detail of the stratigraphy of these soils.

No artifacts were found in Soils XV and XVI, which are part of the fifth depositional unit in Segment B. Soil XV is a poorly

FIGURE 16

West Wall Profile of the Early Archaic/Late Paleo-Indian Component of Segment B





developed B horizon underlain by a fine textured C horizon (Soil XVI). A few prehistoric artifacts were associated with the bottom of Soil XVI. The lack of profile development in Soil XV indicates that Soils XV and XVI represent a relatively short time interval.

The sixth, and final, soil depositional unit consists of Soil XVII which is a well developed argillic B horizon. This soil contained numerous prehistoric artifacts including a corner-notched projectile point similar to Kirk/Palmer varieties which date to the Early Archaic Period. An uncorrected radiocarbon date of 9430 $\pm$ 310 B.P. was associated with this soil and this date is consistent with other dates obtained for Kirk/Palmer varieties throughout the Middle Atlantic and adjacent regions. Soil XVIII was located beneath Soil XVII and is an argillic

horizon that probably belongs to the same depositional unit. It contained no artifacts. No deeper excavations were undertaken in this segment.

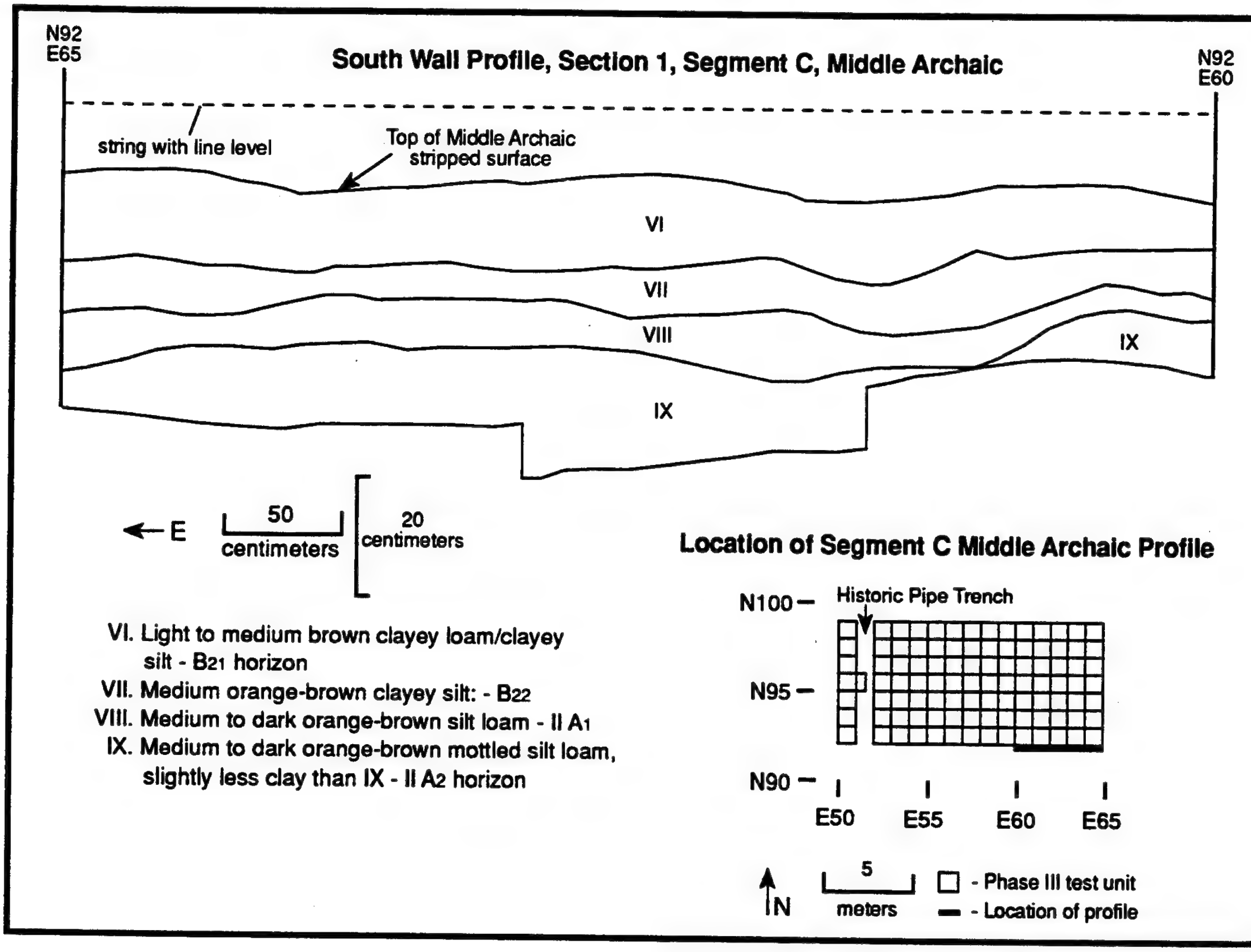
In sum, the profile of Segment B consisted of six depositional units. The uppermost unit consisted of modern fill and is not relevant to the prehistoric archaeological deposits. The second unit has a maximum age of 3500 years based on the presence of Susquehanna broadspears. The presence of these artifacts in later Clemson Island features indicates that the uppermost landscape was a stable surface for occupation for almost 3000 years. The presence of well developed B-horizons in this unit indicates that the entire unit was stable for a long period of time and may well have been deposited over a relatively short period of time. The third unit contained artifacts from the Middle Archaic and a radiocarbon date indicating an age of approximately 8000 years. This unit does seem to be a true paleosol and consists of buried A and B horizons. The B horizon is not well developed and this lack of development, along with the presence of the organic materials in the A horizon, indicate that this horizon was buried rather rapidly and was in a sense sealed from the effects of pedogenesis originating in overlying deposits. The fourth depositional unit contained prehistoric artifacts, but none were diagnostic. The stratigraphic position of the artifacts indicates that they were older than the overlying Middle Archaic artifacts. The soils of the fourth unit are well-developed argillic B horizons indicating that this unit was not buried as quickly as the overlying deposit and had a longer time period of pedogenic stability. The fifth depositional unit contained no artifacts and did not include well-developed B horizons. As was the case with the fourth unit, the absence of well-developed argillic horizons in soils of this age indicates rapid burial of this unit. The sixth, and oldest, depositional unit contained diagnostic prehistoric artifacts and a radiocarbon date indicating an age of approximately 9500 years. The soils of this unit include a well-developed B-horizon indicating that this unit was not buried very rapidly.

Segment C

The composite soil profile for Section I/Segment C is shown in Figure 12. A layer of historic fill (Soil I) is present at the top of the horizon and was not considered a natural soil horizon or depositional unit. The first true depositional unit consists of Soils II - VII. As was the case with the other segments, features with Clemson Island artifacts and Susquehanna broadspears were present in the upper parts of this unit. The mix of artifacts spanning almost 3000 years in the features implies that the landscape associated with the top of this unit was a stable landscape from at least 1500 B.C. to A.D. 1200. Well developed argillic horizons (Soils VI and VII) are also present and these horizons indicate long term profile stability and probably a short time frame of soil deposition.

FIGURE 17

South Wall Profile of the Middle Archaic Component of Segment C

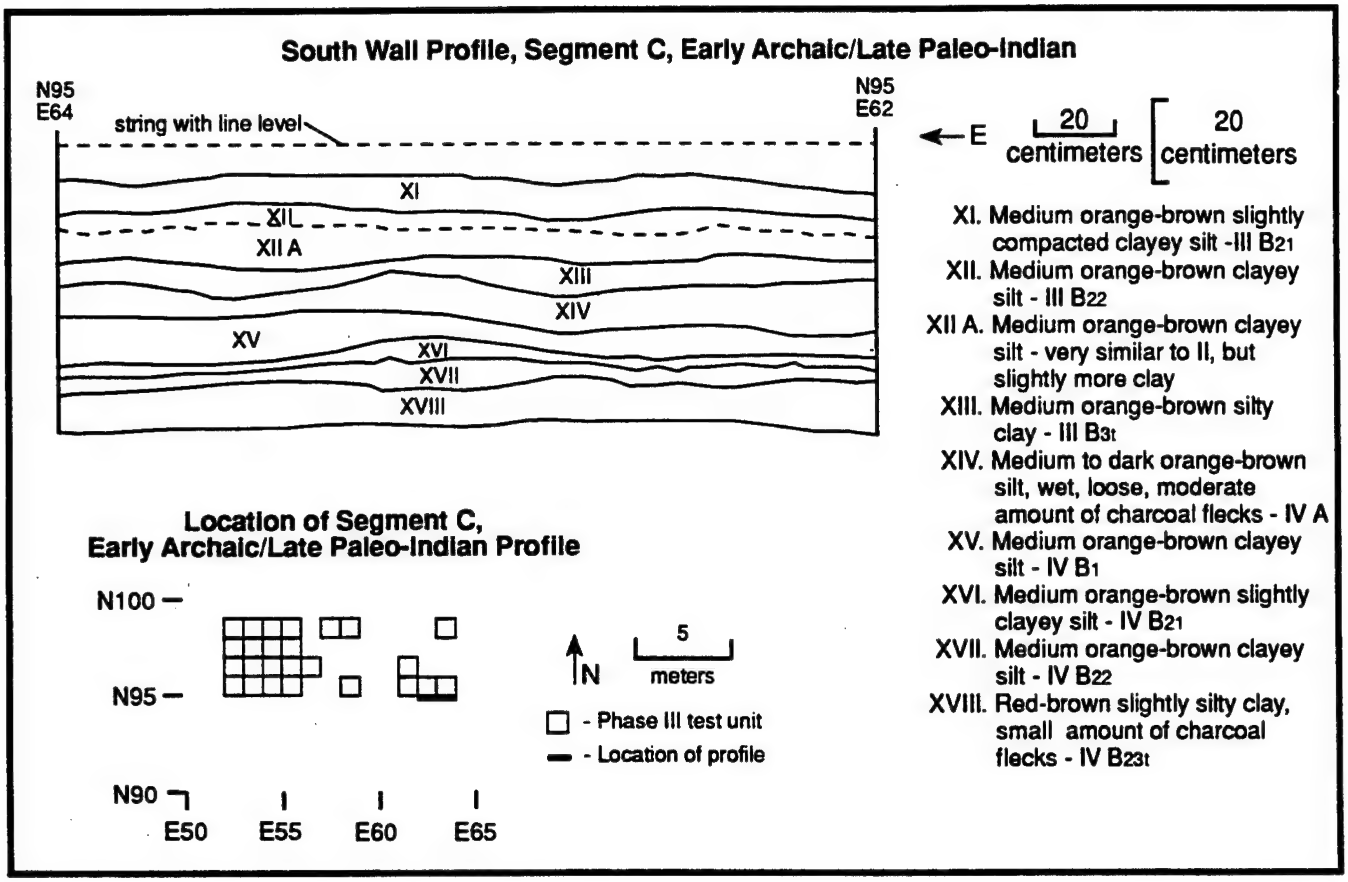


The second depositional unit consists of Soils VIII - X and artifacts were found in this depositional unit. Figure 17 shows a five meter long profile of these soils. Neville points dating to ca. 6500 - 5000 B.C. were found in this unit. Buried A horizons and a well-developed argillic B horizon (Soil X) are present and indicate long-term profile stability and relatively rapid burial of this depositional unit.

Soils XI - XIII comprise the third depositional unit and consist of three buried, well-developed B horizons. Figure 18 shows a detailed profile of these soils. A notched Kirk/Palmer projectile point was found in this depositional unit and indicates an age of ca. 8000 - 7000 B.C. The B horizons are well developed indicating profile stability. Large amounts of gravels are present in this depositional unit and some of these gravels range in size up to 15 cm in their longest dimension. These large cobbles indicate a high energy depositional environment and the original context of the artifacts may be have been disturbed by natural processes.

FIGURE 18

South Wall Profile of the Early Archaic/Late Paleo-Indian Component of Segment C



The fourth depositional unit consists of Soils XIV - XVIII. A buried A horizon (Soil XIV) and a series of argillic B horizons (Soils XV - XVIII) indicate profile stability and rapid burial of this unit. Artifacts were recovered from Soil XVIII, but none were diagnostic. Nevertheless, their stratigraphic position suggests that they are at least 9,000 - 10,000 years old. No deeper excavations were undertaken in this segment.

In sum, the profile of Segment C consist of four depositional units. The uppermost unit has a maximum age of 3500 years based on the presence of Susquehanna broadspears. The presence of these artifacts in later Clemson Island features indicates that the uppermost landscape was a stable surface for occupation for almost 3000 years. The presence of well developed B-horizons in this unit indicates that the entire unit was stable for a long period of time and may well have been deposited over a relatively short period of time. The second unit contained artifacts from the Middle Archaic and is 8500 - 7000 years old. This unit does seem to be a true paleosol and consists of buried A and B horizons. The B horizon is well developed and indicates

profile continuity over time. The presence of the organic materials in the A horizon indicates that this horizon was buried rather rapidly. The third depositional unit contained artifacts that are 9000 - 10,000 years old and the presence of argillic horizons in this unit indicates profile stability. Artifacts in the fourth unit are of unknown age, but must be more than 9000 years old based on their stratigraphic context. The presence of a buried A horizon and well developed B horizons indicates profile stability and rapid burial.

Segment D

Four depositional units comprise the profile of Segment D (Figure 13). The uppermost unit (Soils I and II) consists of fine-grained, undeveloped silty sands with historic artifacts within it, and is not relevant to the prehistoric occupations. This unit probably represents very recent flood deposits. The results of Phase II testing at the site suggested that the soils of the second depositional unit, especially Soil IV, contained intact living surfaces. Figure 19 shows a 2 m profile of these soils. Phase III excavations in these soils showed that Contact Period, Clemson Island Complex, and Susquehanna broadspears were present intermixed in this depositional unit and that no intact landscapes were present. Prehistoric pit features which originated in this unit intruded into Soils V and VI of the underlying third depositional unit.

The third depositional unit consists of a buried A horizon (Soil V) and a series of well developed B horizons (Soils VI - IX). Diagnostic artifacts including Neville/Stanly projectile points dating to ca. 6500 - 5000 B.C. were found in this unit and Figure 20 shows a detailed profile of the soils with these artifacts. The well developed B horizons and the preserved A horizon indicate profile stability and rather rapid burial of this unit. No artifacts were recovered from the fourth depositional unit. No deeper excavations were undertaken in this segment.

In sum, the top depositional unit of this segment is not relevant to the cultural stratigraphy of the site. The second depositional unit has a maximum age of 3500 years based on the presence of Susquehanna broadspears. The presence of these artifacts in later Clemson Island Complex and Contact Period features indicates that this depositional unit was probably a stable surface for occupation for more than 3000 years. The third unit contained artifacts from the Middle Archaic and is 8500 - 7000 years old. This unit does seem to be a true paleosol and consists of buried A and B horizons. The B horizon is well developed and indicates profile continuity over time. The presence of the organic materials in the A horizon, indicates that this horizon was buried rather rapidly.

FIGURE 19

North Wall Profile of the Contact Period and Clemson Island Component of Segment D

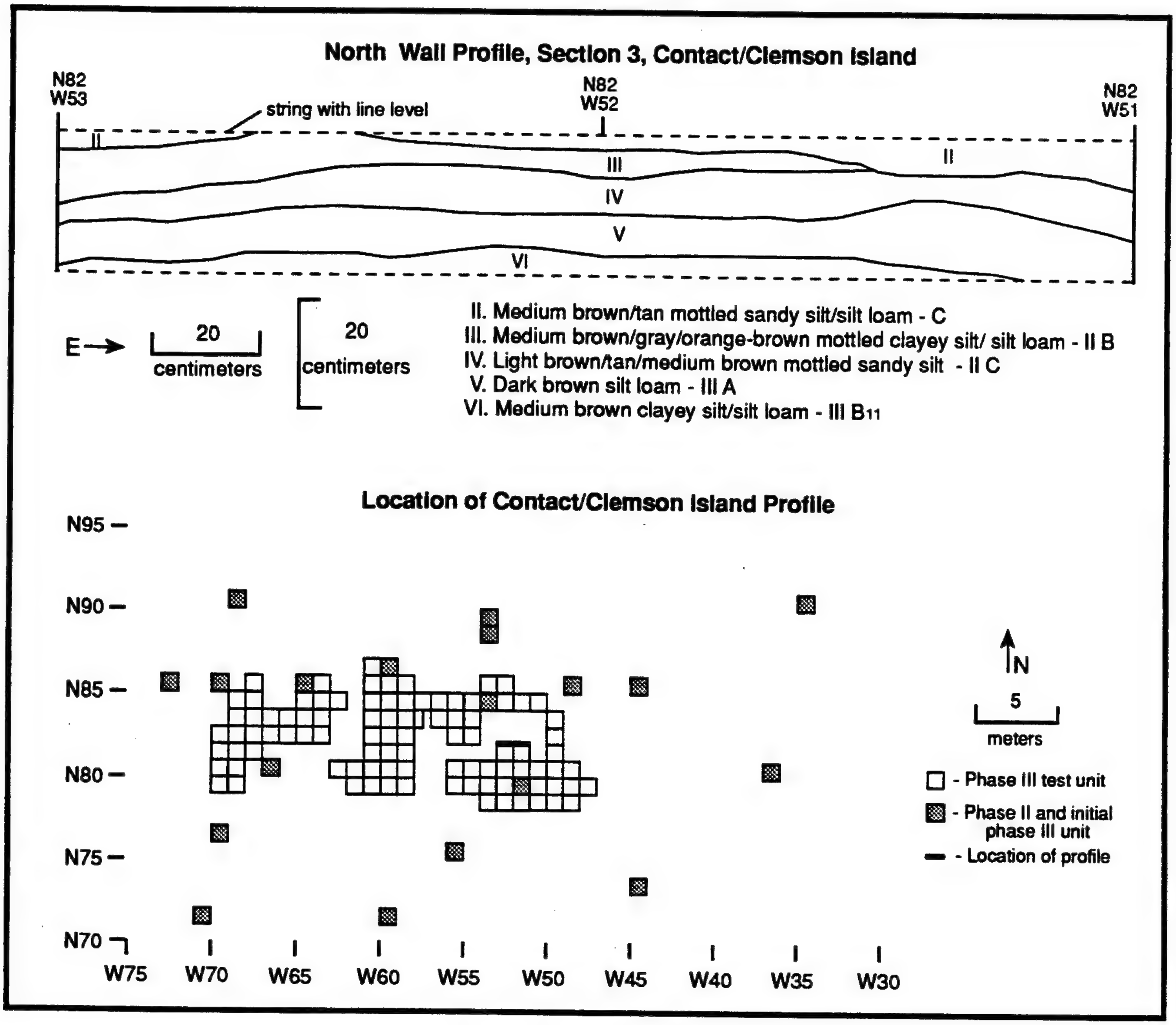
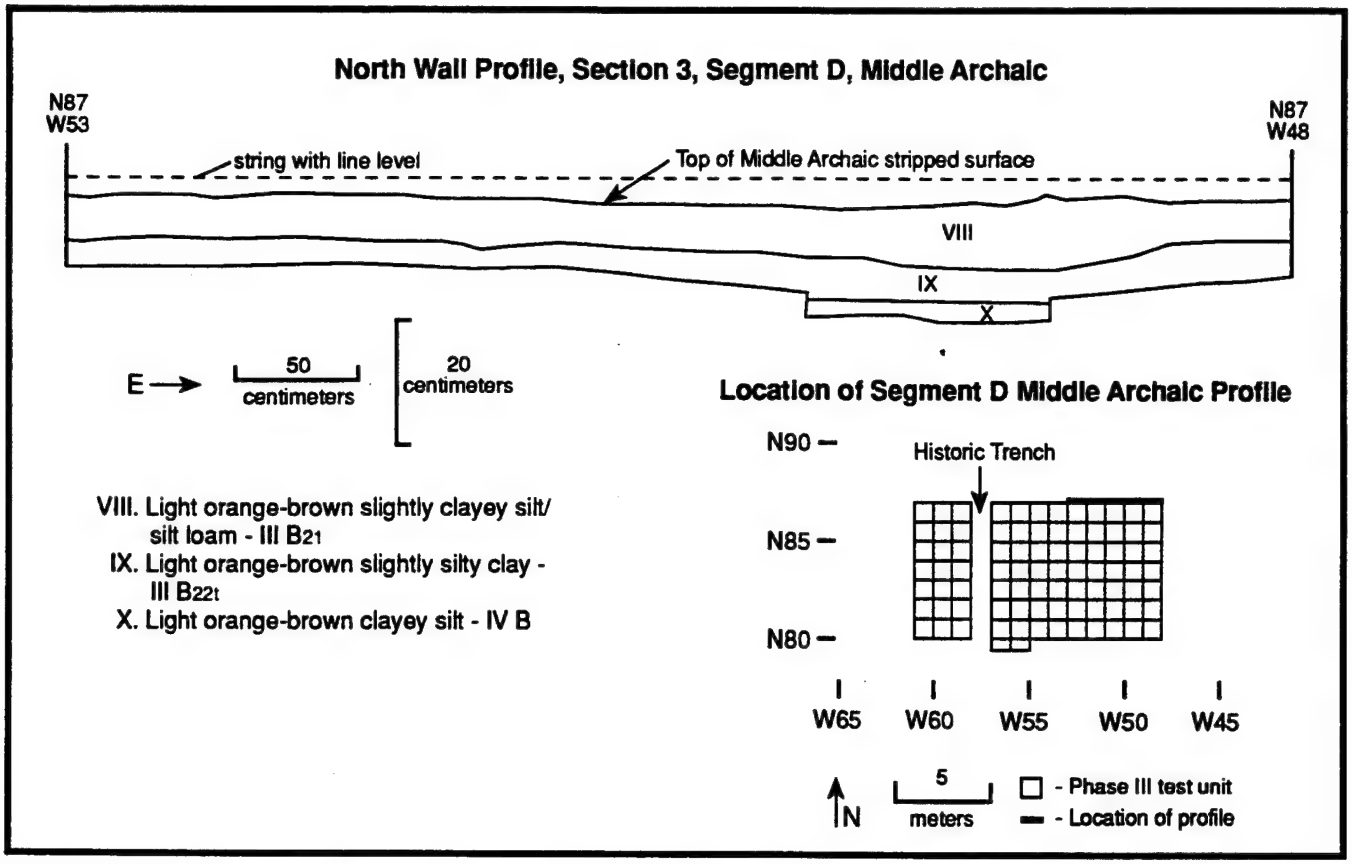


FIGURE 20

North Wall Profile of the Middle Archaic Component of Segment D



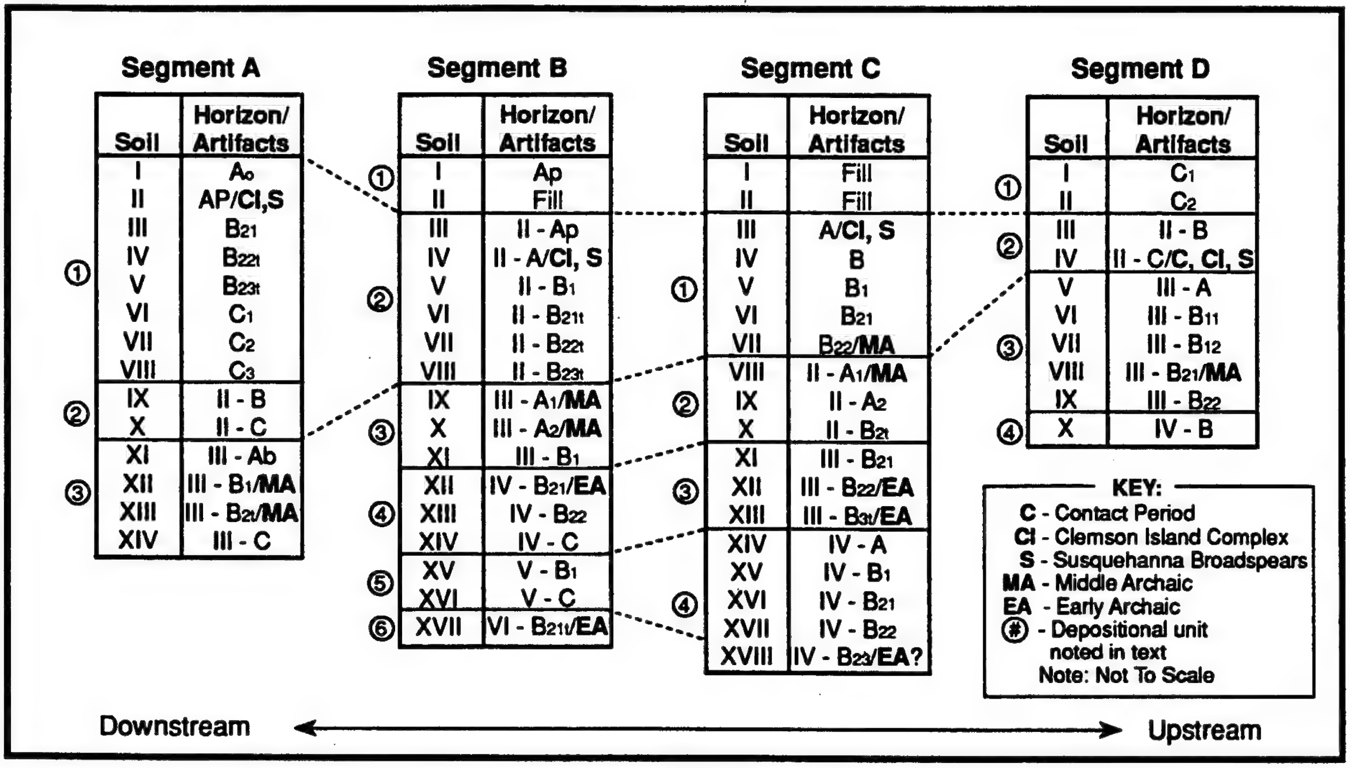
Discussion

Figure 21 summarizes the horizon descriptions, depositional units, and stratigraphic distribution of cultural deposits at the West Water Street Site. Chronostratigrapic correlations of the major depositional units are also noted where they could be made. The data summarized in Figure 21 provides the basis for the discussion of a number of topics.

The most significant topic to discuss is the contextual integrity of the cultural deposits at the site. The most recent cultural component consists of Contact Period, Clemson Island Complex (Late Woodland), and Susquehanna Broadspear (Late Archaic Period) occupations. These occupations co-occur in various combinations in mixed contexts in the upper portions of Depositional Unit (DU) 1 in Segment A, DU2 in Segment B, DU1 in Segment C, and DU2 in Segment D. In most cases the Susquehanna broadspears co-occur with Clemson Island Complex artifacts in soil pit features. In Segment D, Contact Period artifacts dating to ca. A.D. 1725-1775 are also present. Applying the principles terminus post quem dating, it can be concluded that the Late Archaic Period Susquehanna broadspear artifacts were present in surface soils during the Clemson Island occupation and were

FIGURE 21

Summary of Profiles and Chronostratigraphic Correlation of Depositional Units



accidentally included with the soils that filled in the Clemson Island, or Contact Period, pits. Therefore, the Clemson Island and Contact Period pits contain a mix of artifacts from numerous time periods that pre-date the Clemson Island occupation. This mix of artifacts in these features makes the interpretation of the pit contents difficult and renders suspect any associations of artifacts found within them. Furthermore, the cultural provenience of small ecofacts recovered from flotation of the pits and any carbon samples is at best problematic. Moeller (1993) has recently addressed similar issues in a reanalysis of similar pit features from sites in the Upper Delaware Valley.

In general, the contextual integrity of the Contact, Clemson Island, and Susquehanna broadspear components is compromised by the fact that the living surfaces of the upper portions of the most recent prehistoric depositions units were open and not buried by alluvial deposits for more than 3500 years. This long period of exposure allowed for the accumulation and mixing of artifacts from numerous different time periods. In some ways, the upper levels of the West Water Street Site can be viewed as analogous to a historic plow zone in which the soils and artifacts become mixed as a land surface is exposed and disturbed. In a plow zone, the disturbance comes from agriculture. However, at the West Water Street Site the disturbance came from multiple prehistoric inhabitants who dug

pits for various purposes across the site over time. Nonetheless, even though some aspects of the depositional integrity of these occupations are compromised, we can still learn much about prehistoric lifeways from the analysis of the excavated artifacts.

The depositional context of the Middle Archaic deposits is quite different from that of the younger deposits. The Middle Archaic deposits at the West Water Street do not co-occur with artifacts of earlier and later time periods and have a very limited vertical distribution at the site. In all four segments, a buried A horizon is present in the same depositional unit within which the Middle Archaic artifacts are found, even though the Middle Archaic artifacts are not always found in the A horizon itself. The distinctive nature of the Middle Archaic diagnostic artifacts allows the chronostratigraphic correlation of DU3 in Segments A, B, and D, and DU2 in Segment C. Preservation of the organic A horizons implies a rapid burial of the Middle Archaic depositional units (Birkeland 1974:6) and such rapid burial minimizes the subsequent disturbance of the cultural deposits. Incipient development of B horizons in the Middle Archaic depositional units also implies that the unit was relatively stable when exposed and was not subject to extensive disturbance. The fine textures of the soil matrices of these depositional units also implies the kind of low energy depositional environments that would be expected in the site's levee setting. Such low energy depositional environments would not readily disturb artifact associations. In sum, the Middle Archaic components at the West Water Street Site are in excellent stratigraphic context.

The Early Archaic components are present only in Segments B and C. In both cases, two different occurrences of artifacts predating the Middle Archaic are present in different stratigraphic contexts. For the most part, the depositional units associated with Early Archaic materials are truncated, except in the case of DU4 in Segment C. Nevertheless, Early Archaic artifacts were found in well-developed B horizons implying significant profile stability. Extensive pedogenic development of the soils containing the Early Archaic artifacts makes it difficult to assess the original soil textures and morphologies. However, it can be noted that except for the more shallow Early Archaic deposit in Segment C, all of the early Archaic artifacts are found in soils that show no sign of being deposited in high energy environments. The exception is the Early Archaic component in Soil XIII of Segment C which included many very large cobbles. In sum, both Early Archaic occupations in Segment B and the deeper Early Archaic occupation in Segment C are in good stratigraphic context. The artifacts in the upper Early Archaic deposit of Segment C may have been disturbed by high energy deposition of soils in a crevasse-splay or flood chute feature that breached the levee.

The chronostratigraphic correlation of depositional units in Figure 21 also allows a discussion of episodes of landscape

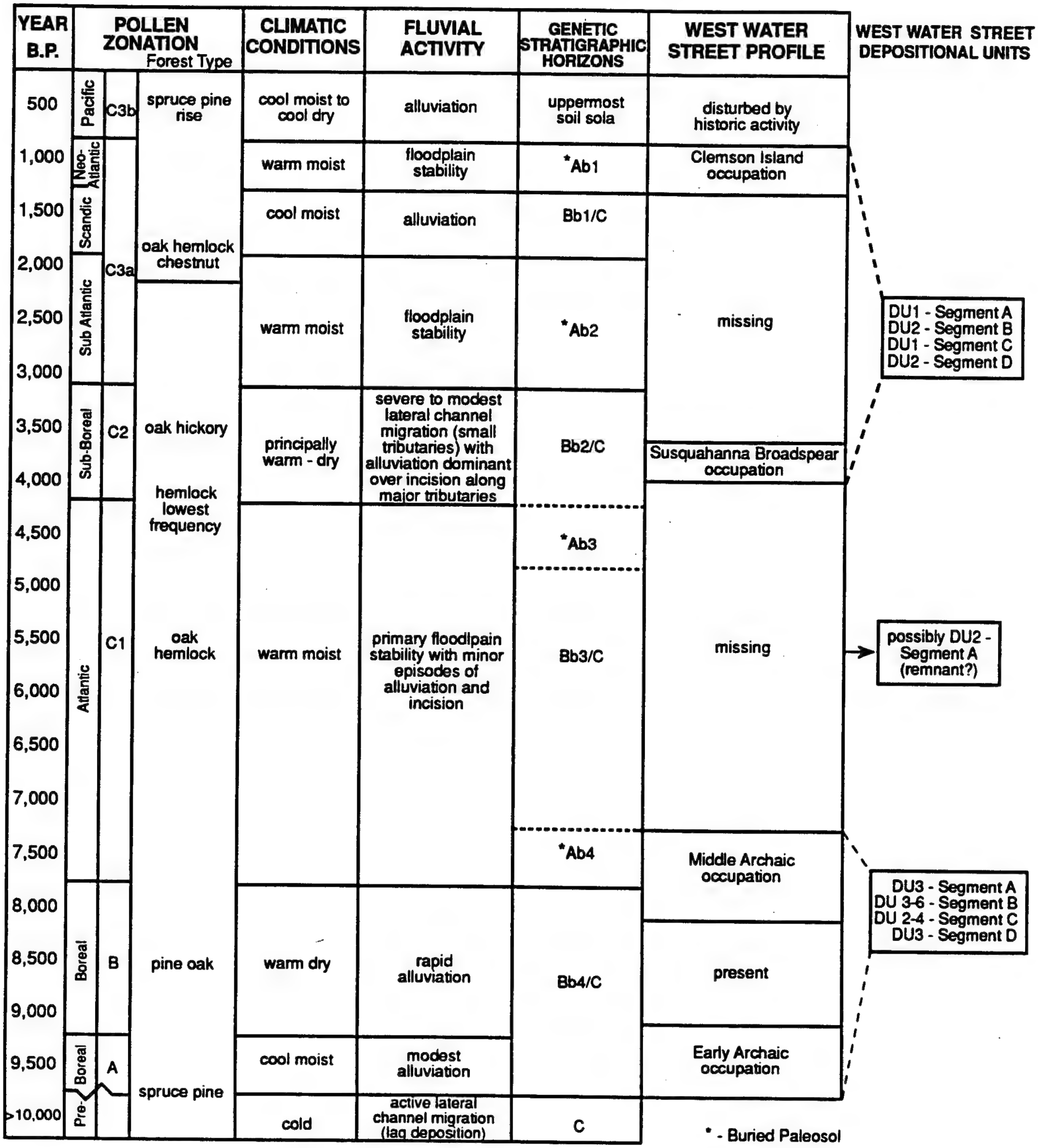
stability at the site. It is important to note that the chronostratigraphic correlations in Figure 21 are not meant to correlate the actual soil profile characteristics across the site. Too much variability exists in these profiles. Rather, the correlations attempt to use information that can date the occupation surfaces to match up similar points in time across the site. Given the archaeological context of the chronological data, the "similar" points in time could span centuries; however, such broad-scale correlations are useful in examining stratigraphic changes over the long periods of time represented by the total occupation span of the West Water Street Site. The following discussion of the stratigraphic changes at the West Water Street Site explicitly considers the applicability of the genetic stratigraphy model for the Susquehanna basin developed by Vento and Rollins (1989). Figure 22 shows the basic genetic stratigraphic model, its relation to past changes in climate and environment, the expected genetic stratigraphic horizons, and the corresponding depositional units and cultural stratigraphy of the West Water Street Site.

There is a clear-cut correlation of depositional units containing Clemson Island and Susquehanna broadspear occupations across the site (Segment A-DU1, Segment B-DU2, Segment C-DU1, Segment D-DU2). In all but Segment D, an A horizon is present and this correlation of depositional units could be viewed as equivalent to the "Clemson Island" paleosol described by Vento and Rollins (1989). However, the consistent association of much older Susquehanna broadspears with the Clemson Island age surface at the West Water Street Site is not consistent with the sequence proposed by Vento and Rollins. In essence, the floodplain accretion ("alluviation" in the Vento and Rollins model - Figure 22) associated with the Scandic climatic episode prior to the development of the Clemson Island paleosol did not occur at the West Water Street Site. Similarly, the soils associated with the time period of "floodplain stability" associated with the Sub-Atlantic climatic episode are not present either. As shown in the right hand columns of Figure 22, the sequence of two depositional cycles hypothesized by Vento and Rollins for the time period between 4000 B.P. and 500 B.P. is collapsed into a single depositional event at the West Water Street Site.

Two scenarios could account for the observed co-occurrence of the Clemson Island and Susquehanna broadspear components. The preferred scenario described earlier in the interpretation of the depositional units would view the time period spanned by the occupation as one of great landscape stability at the site. In this scenario, the cool and moist Scandic climatic perturbation had little effect on the alluviation of the Susquehanna River in this locale and the predicted alluviation of the model did not occur. An alternative explanation would be to suggest that alluvial soils had been deposited at the site and eroded away between the time period of the Susquehanna broadspear and Clemson Island occupations. The explanation would also account for the

FIGURE 22

Genetic Stratigraphy of the West Water Street Site



fact that very few artifacts from the intervening Early and Middle Woodland time periods were found at the site in spite of the large scale Phase III excavations and intensive Phase II testing. However, we feel that two sets of data render this explanation suspect. First, no signs whatsoever of the eroded landscape were identified. It would be hard to imagine that the entire soil profile would be removed with no remnant segments preserved. Second, and more importantly, the genetic stratigraphic model predicts alluviation, not erosion, in levee settings for the time in question. Consequently, the explanation stressing greater stability of the floodplains during the Scandic climatic episode is preferred. This deviation from the predictions of the Vento and Rollins model is, in reality, quite minor and can be expected given the natural variability in soil formation processes.

A second deviation from the genetic stratigraphic model occurs during the time period of Atlantic episode. The entire depositional unit projected by the model is missing from the West Water Street profile. Likewise, the "pre-broadspear" Late Archaic components, known locally as the Canfield Island Complex (Bressler, Maietta, and Rockey 1983; Bressler 1993), are missing from the cultural sequence. Vento and Rollins (Vento and Rollins 1989:Figure 1) describe this time period as one of "primary floodplain stability with minor episodes of alluviation and incision." Furthermore, the later Sub-Boreal episode is characterized as a time period of "severe to modest lateral channel migration (small tributaries) with alluviation dominant over incision along major tributaries" (Vento and Rollins 1989:Figure 1). It is suggested here that one of these episodes of incision or lateral channel migration could have affected the levee area of the West Water Street Site and eroded away the missing depositional unit associated with the Atlantic climatic episode. This explanation is more likely to be applicable to this section of the West Water Street profile than it was for the missing Scandic deposits because DU2 of Segment A could be interpreted as a remnant of the missing soil deposits. Thus, the West Water Street profile can be interpreted as being consistent with the genetic stratigraphic model for this time period.

The bottom section of the West Water Street profile with its buried depositional units with Middle and Early Archaic deposits and associated paleosols is entirely consistent with the model proposed by Vento and Rollins. The "modest alluviation" proposed by the model for the Pre-Boreal episode matches well with the presence of two distinct buried Early Archaic deposits and the more rapid alluviation of the Boreal episode corresponds to the soils separating the Middle and Early Archaic deposits and the thicker soils of the Middle Archaic depositional unit in Segments A and D.

In conclusion, the stratigraphic data from the West Water Street Site provides useful information concerning the contextual integrity of the archaeological components. Some components (Middle Archaic and most of the Early Archaic) have excellent

contexts while the context of others (Contact, Clemson Island, and Susquehanna broadspear - Late Archaic) are compromised. The stratigraphic data also nicely match most of the predictions of the genetic stratigraphy model proposed by Vento and Rollins (1989) for the Susquehanna Valley. Where the profile does not match the predictions of the model, the differences are easily explained by the inherent variability in soil formation processes. It is important to note that the places where the West Water Street profile does match the profile are the time periods where the model's predictions are the most specific and least likely to be affected by natural variation in soil formation processes. Therefore, the West Water Street profile is an excellent confirming test of the model proposed by Vento and Rollins and underscores the validity of their hypothesized links between past climatic changes and geomorphic processes in the Upper Susquehanna watershed.

ANALYSIS OF LATE ARCHAIC - CONTACT COMPONENT CONTEXT

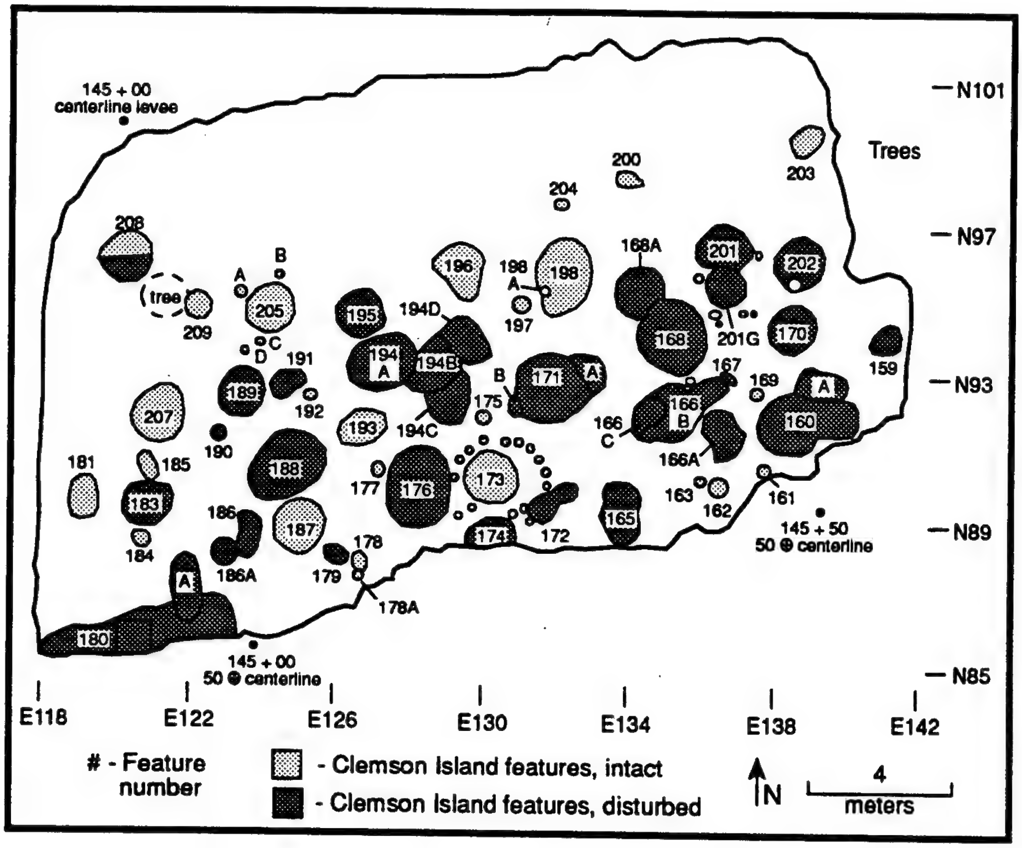
This section of the report will discuss the context of the features and artifacts associated with the Late Archaic through Contact Period occupations at the West Water Street Site. At least three occupations are represented in the soils from below the historic fill to approximately 1 m below ground surface, including a Late Archaic occupation, a Clemson Island occupation, and an occupation from the Contact Period. The vertical position of these occupations, and the soils in which they were contained, are also discussed in the section on Site Stratigraphy. They are being considered here as a group, due to their shallow depth at the site, and the lack of sterile soil horizons separating them.

Data Recovery investigations in this portion of the site included the excavation of features associated with both the Contact and Clemson Island occupations, as well as test unit excavation of potential living surfaces thought to be associated with each of the Periods. Artifacts from all three Periods were found mixed together in features and within test unit levels. Some artifact mixing and movement at the site has doubtlessly been accomplished through natural processes such as rodent and root disturbances and soil freeze/thaw cycles. Other disturbances have resulted from cultural processes; specifically, the original digging of pit features by Native American groups that intruded into earlier artifact deposits as well as into earlier pit features.

A more detailed description of the mixing of the occupations at the site is presented below. For purposes of organization, the Contact and Clemson Island feature maps have been divided into four figures. Figures 23-25 show the location of Clemson Island and Contact Period features in Section I, and Figures 26 and 27 show their location in Section III. Those features which contained diagnostic artifacts and the types of diagnostic artifacts recovered are listed in Appendix I. All features have been coded as to whether their context is considered to be

FIGURE 23

Locations of All Features in the Eastern Portion of Section 1

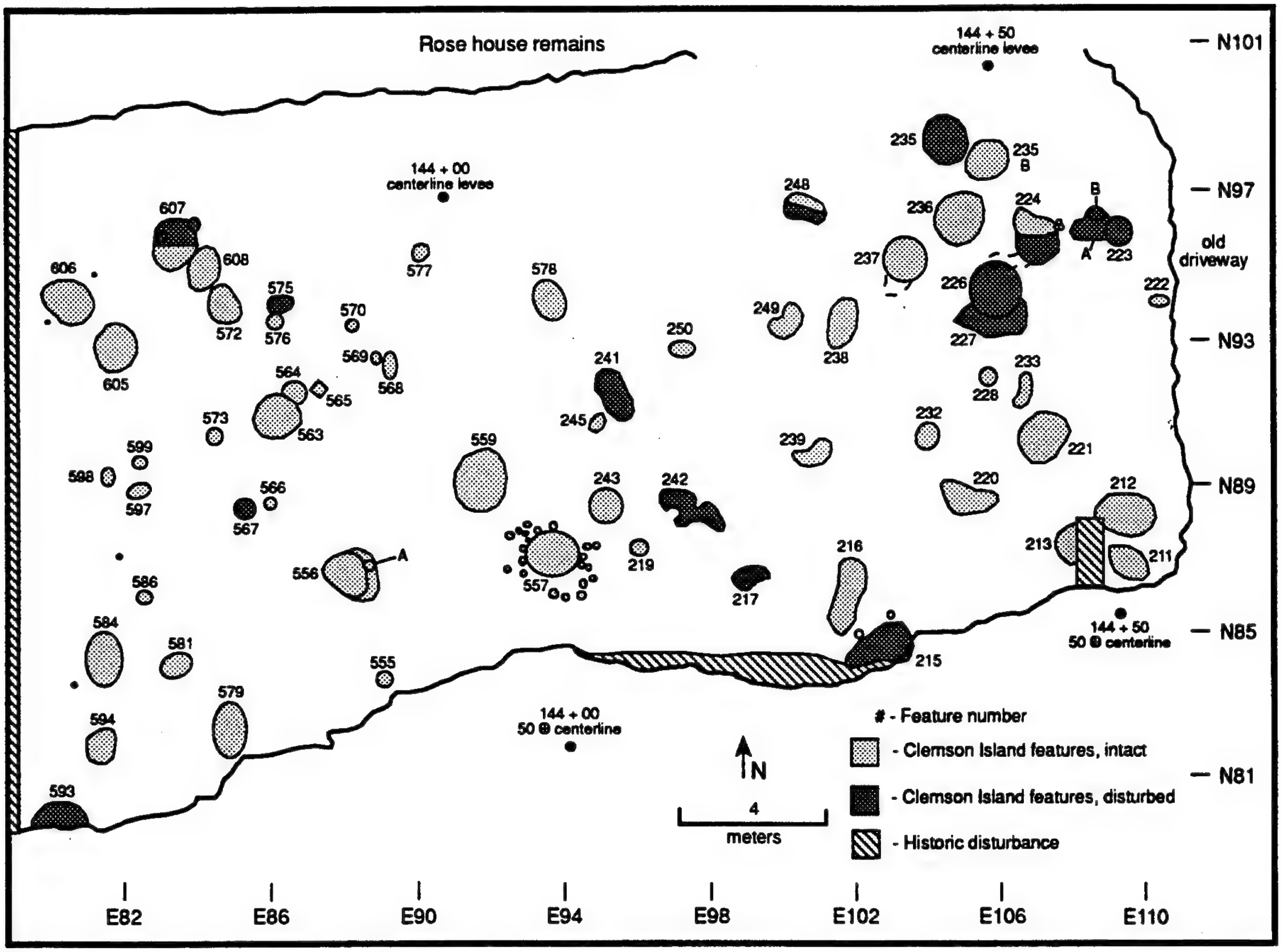


disturbed or intact. Disturbed features include those that were cross-cut by, or intrude into, a separate feature, those that exhibited natural disturbances, and those which contain diagnostic artifacts from more than two cultural periods, or from only the Late Archaic Period.

The main diagnostic artifacts used to identify mixing of cultural components were Late Woodland ceramics, Susquehanna broadspears, and triangular projectile points. Some other diagnostic artifacts were present, but the types noted above were the most numerous and the most useful. Susquehanna broadspears date to the time period of 1500-1200 B.C. and in the absence of post-depositional disturbances should not be associated with any of the other diagnostic artifacts which post-date A.D. 1000. The main diagnostic ceramic types, from oldest to youngest, are Clemson Island (thick, coarsely grit-tempered, cord-marked pottery with simple cord impressed designs), Shenks Ferry (thinner, finely grit-tempered, cord-marked pottery with simple incised designs), and Susquehannock (thin, shell-tempered, smoothed pottery with complex incised designs). Although associations of Clemson Island and Shenks Ferry pottery and associations of Shenks Ferry and Susquehannock pottery might be expected in the absence of post-depositional disturbance, associations of Clemson Island and Susquehannock ceramics clearly indicate post-depositional disturbance (Hatch 1983).

FIGURE 24

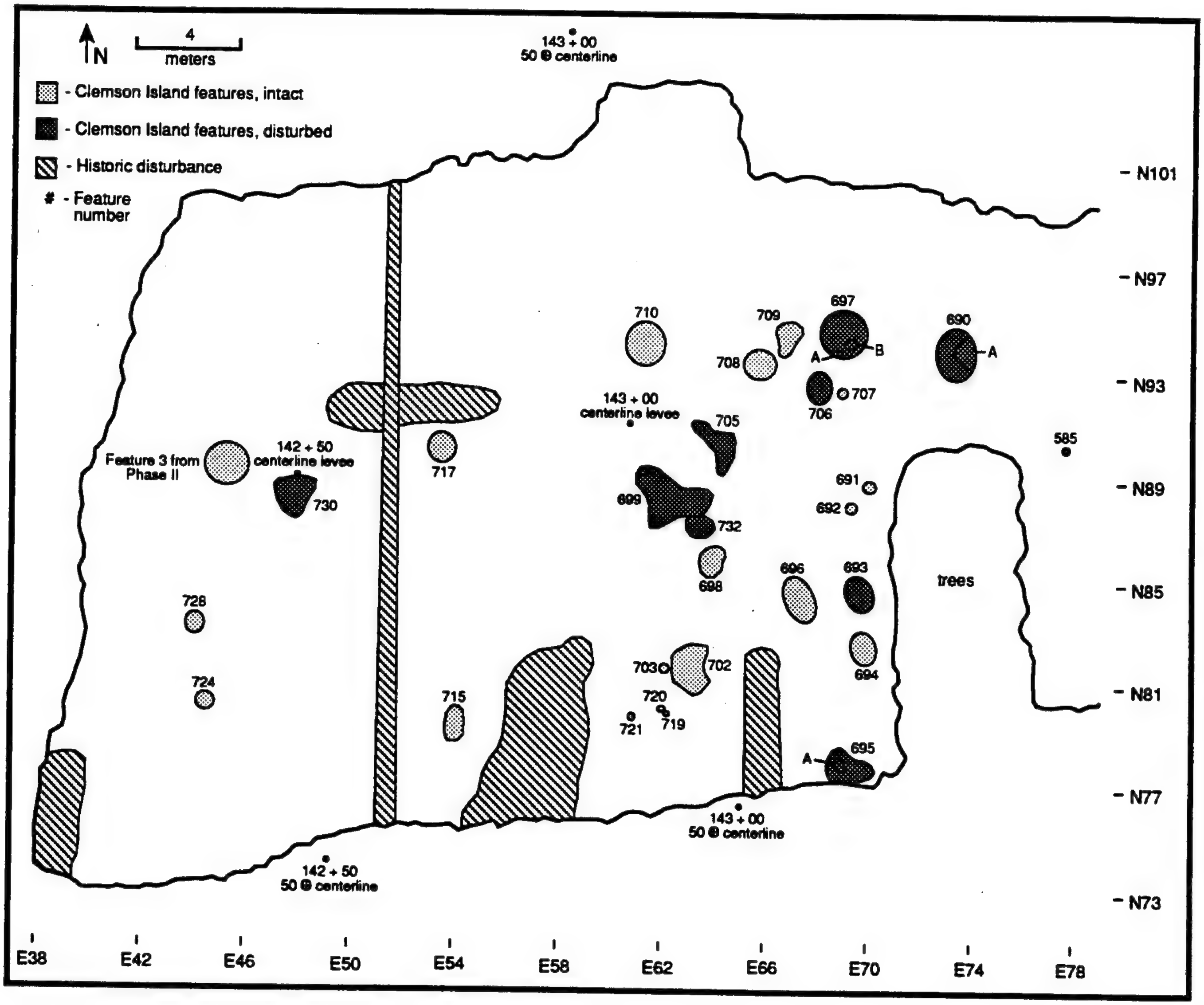
Locations of All Features in the Middle Portion of Section 1



It should be noted here that a basic assumption has been made regarding the features at the site which contain diagnostic artifacts only from pre-Clemson Island periods. The assumption is that these features probably, although not definitely, relate to the Clemson Island period, even though they do not contain diagnostic Clemson Island artifacts. This assumption also applies to features which contained no diagnostic artifacts. The reasons for this assumption are as follows. First, it has been demonstrated that some features with Clemson Island diagnostic artifacts also contain artifacts from earlier occupations. It has also been demonstrated that soils into which the Clemson Island features were dug contain Late Archaic artifacts not in features. These findings suggest that mixing of artifacts between the two occupations is likely. A comparison of the shape, contents, and location of the features with only Late Archaic diagnostic artifacts to those with Clemson Island artifacts does not indicate any significant differences. Furthermore, there are too few of these features present for them to exhibit any significant spatial distribution patterns. It is therefore suggested that

FIGURE 25

Locations of All Features in the Western Portion of Section 1



the non-Contact features at the site are all probably from the Clemson Island Period. There is, however, a small possibility that they may be earlier in age. Appendix I summarizes the data on cultural affiliation and diagnostic artifacts for all features.

The majority of features excavated at the West Water Street Site did not contain diagnostic artifacts. Of those that did, most of the diagnostic artifacts were from the Clemson Island occupation. In some cases, artifacts from the Contact, Clemson Island, and Late Archaic Periods were found together in the same feature. In other cases, the only diagnostic artifacts recovered from a feature were from the Late Archaic Period. As previously mentioned, the three different occupations are not stratigraphically separated, and artifacts from the Contact,

FIGURE 26

Locations of All Features in the Eastern Half of Section 3

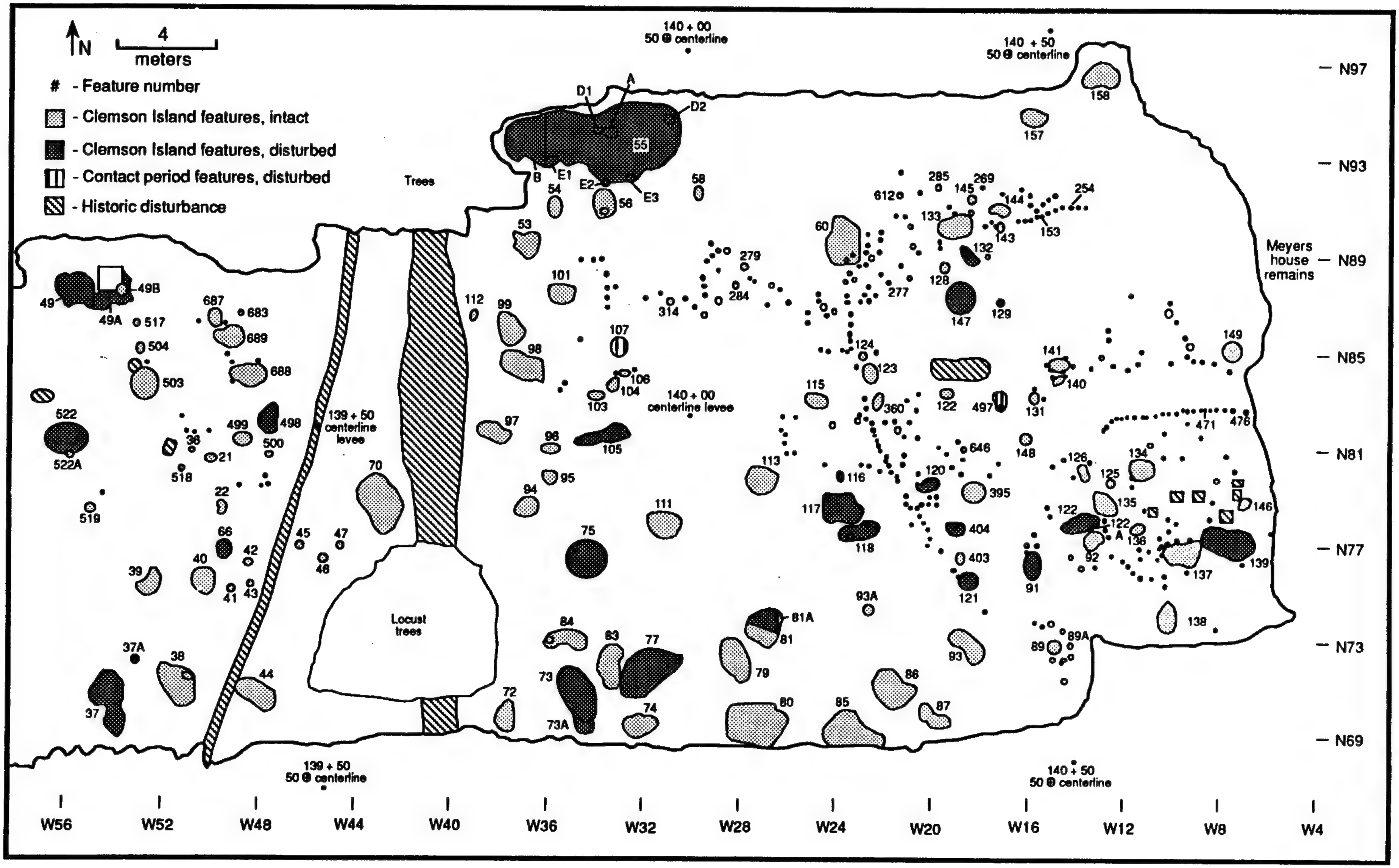


FIGURE 27

Locations of All Features in the Western Half of Section 3

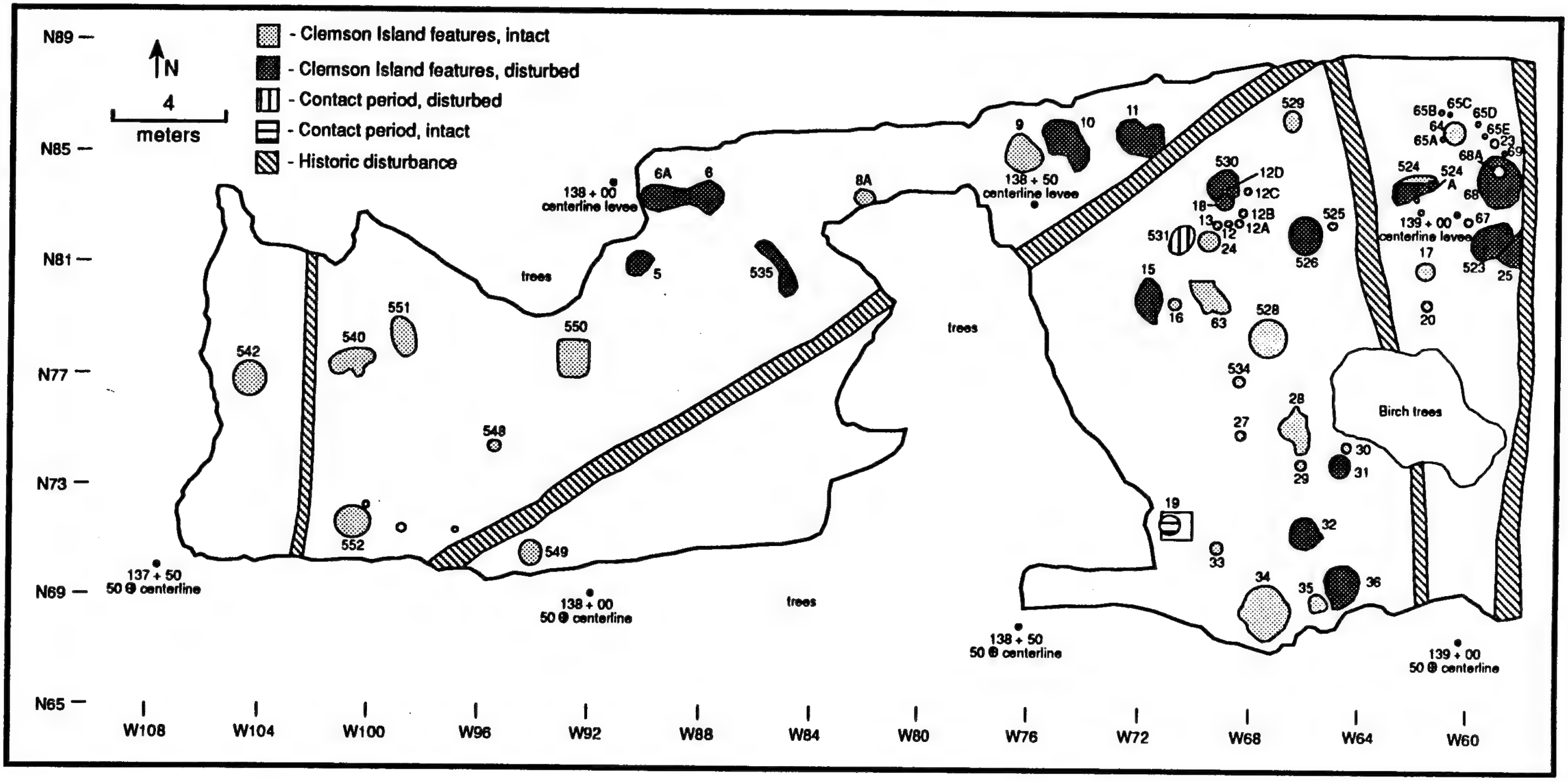


FIGURE 28

Locations of All Test Units Excavated to Test the Potential Contact, Clemson Island, and Late Archaic Living Surface

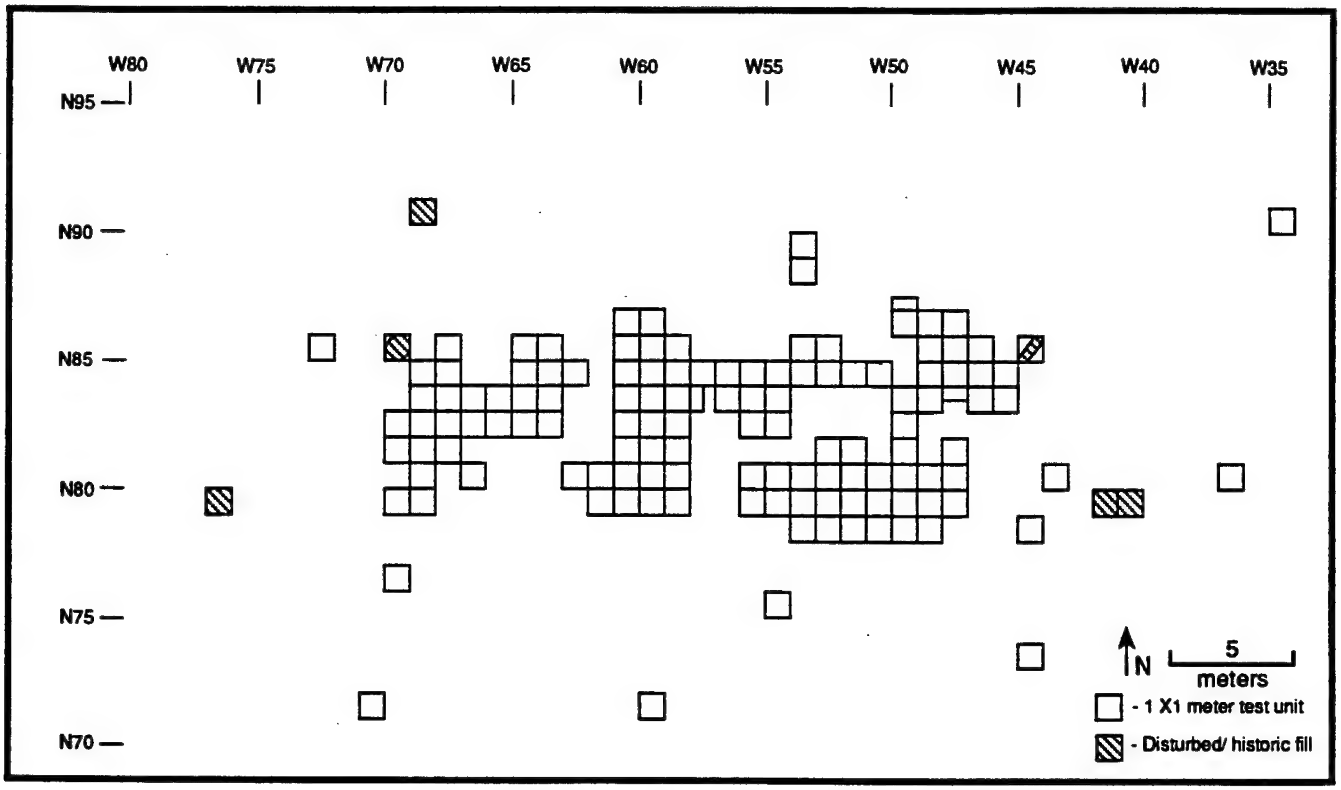


TABLE 6

Features and Diagnostic Artifacts from the Contact Period Occupation

Feature	Section	Context	Clemson Island Artifacts Present?	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts in Feature
19	3	intact	No	No	No	olive glass, brass ring fragment, Ceramic ? type
81A	3	disturbed	Yes	No	No	Clemson Island ceramic, bead, pipe stems, mountain lion canine
107	3	disturbed	No	No	Yes	Shenks Ferry ceramic, olive glass, blue glass
497	3	disturbed	Yes?	No	No	Post-brass fragment, glass bead, corn, ceramic ? type
531	3	disturbed	Yes	No	Yes	Burial- beads, rings, jew's harp, Clemson Island, Shenks Ferry ceramic

Clemson Island, and Late Archaic Periods were found in the same soils. This situation makes it difficult to assign cultural affinity to the features based solely on the diagnostic artifacts recovered from them. Features which contained non-intrusive Contact Period artifacts may be assumed to relate to that occupation. Features which contained only diagnostic Clemson Island artifacts are most likely related to the Clemson Island occupation, but do have the slight potential to be later Contact Period features which were dug into soils containing Clemson Island artifacts. The same situation exists regarding features containing Clemson Island and/or Late Archaic artifacts. Features containing artifacts from both of these periods are assumed to be Clemson Island-age features which were originally dug into soils containing artifacts from the Late Archaic occupation of the site, with the artifacts from both periods becoming mixed in the feature fill. Features which contain diagnostic artifacts from only the Late Archaic Period may relate to that occupation, or they may be Clemson Island features without Clemson Island diagnostic artifacts. Table 6 lists the features and diagnostic artifacts from the Contact Period occupation. A listing of all features and the diagnostic artifacts found within them is contained in Appendix I.

Figure 28 shows the location of the meter square units excavated to test the potential Contact and Clemson Island Period living surfaces, and Figure 28 also shows the location of units excavated to test the potential Late Archaic living surface. A listing of the diagnostic artifacts found in the test units is presented in Appendix II.

Figure 23 shows the location of all features found in the eastern portion of Section I. A total of 65 features were identified in this area, and no features containing Contact Period artifacts were discovered here. This area produced the highest density of features in any part of the site, and consequently there are a large number of overlapping, intrusive features. Features 194A through D, a series of four intersecting features, are one example. Of the total number of features, 32 are considered disturbed, and 33 are intact. Sixteen of the disturbed features are labeled such because they contain a natural disturbance, or intersect another feature. Of the diagnostic artifacts recovered from features, seven of the intact features contained only Clemson Island ceramics, as did eight of the disturbed features. Three features had only Susquehanna broadspear bifaces, and one feature (Feature 188) had a broadspear, a fishtail point, and steatite fragments. Five features contained both a broadspear and Clemson Island ceramics. Three other features had a Susquehanna broadspear and prehistoric ceramics which were too small to identify. Feature 176 contained a teardrop-shaped biface, a side-notched projectile point, Clemson Island ceramic, and other ceramics which appeared to be Shenks Ferry. Feature 191 contained a stemmed point, and Feature 194D contained Shenks Ferry ceramics. Forty of the features in this area had no diagnostic artifacts at all.

Figure 24 shows the location of all features in the middle portion of Section 1. Feature densities were much reduced here, and the number of disturbed features is correspondingly less than the eastern portion of Section I. From a total of 61 features, 16 are considered disturbed, and all but three of these are disturbed because they intersect another feature or contain a natural intrusion or disturbance. Feature 235 contained a mix of artifacts from the Contact through Late Archaic Periods. The Contact Period artifacts consisted of a single glass bead, and a piece of lead shot. Considering the small size of these artifacts, they may be intrusive. The feature also contained Shenks Ferry ceramics, Clemson Island ceramics, and a Susquehanna broadspear. Feature 575 also contained intrusive Contact Period artifacts, as well as Shenks Ferry ceramics. Nine of the intact features contained Clemson Island ceramics, as did one feature disturbed by another feature. None of the features in this middle portion of Section I had only Late Archaic diagnostic artifacts.

Figure 25 shows the location of all features from the western portion of Section I. The density of features is even less than in the middle portion of the Section, with a total of 33 features identified here. Fourteen of the features were disturbed, ten by natural intrusions or intersecting features. One feature (Feature 697) contained a Susquehanna broadspear and prehistoric ceramic sherds which were too small to identify by type. The only intact feature in this section containing clearly diagnostic artifacts was Feature 3, which was excavated during Phase II testing at the site. Feature 709 contained small fragments of Native American-manufactured pipe. One feature contained Shenks Ferry ceramics, and two others contained shell-tempered ceramic and quartz tempered ceramic, respectively. Feature 730 had a fragment of steatite in it. The feature is not considered to be disturbed, because the small fragment of steatite may have been a piece of an ornament, and not a bowl fragment.

Figure 26 shows the location of features in the eastern half of Segment III. This area contained 121 features, the majority of which were intact. Of the 29 that were disturbed, 11 were features which cross-cut other features, or had rodent or root disturbances. Six features (Numbers 75, 77, 81, 107, 120, and 147) had a mix of artifacts from the various occupations. Features 75 and 147 each contained a single artifact from the Contact Period, which are thought to be intrusive. Feature 147 also contained Clemson Island ceramics and a Susquehanna broadspear, indicating that artifacts from all three of the occupations are present in this one feature. Features 81 and 107 are from the Contact Period, but also contained Clemson Island and Shenks Ferry ceramics, respectively. Feature 120 had both Shenks Ferry and Clemson Island ceramics in it, and Feature 77 had a side-notched point and ceramic sherds of an unknown type.

Eleven features in the east half of Segment III had a variety of non-Clemson Island diagnostic artifacts in them. These features include Features 139 and 498 which contained shell-tempered ceramic, Feature 121 which had clay-tempered ceramic, and Features 91, 105, 116, 122, 132, and 404 which had various stemmed and notched projectile points. Feature 129 contained a single glass seed bead, recovered from a flotation sample. Eight intact features contained diagnostic Clemson Island artifacts.

The location of all features in the west half of Segment III is shown in Figure 27. Fifty-six features were found in this area, of which 40 were intact. Of the disturbed features, only six were considered disturbed by other features or natural intrusions. Artifacts from more than one occupation were found in six features, including Feature 531, a Contact Period burial. This feature contained numerous European-manufactured trade goods, such as glass beads and brass finger rings, but it also contained Clemson Island ceramics. Other features with a mix of artifacts include Feature 15 (fishtail projectile point and ceramic), Feature 32 (Shenks Ferry ceramics and Clemson Island ceramics), and Feature 68, which had a notched point, a stemmed point, and Clemson Island ceramic. Feature 11 contained a piece of olive green bottle glass with Clemson Island ceramic, but the Contact Period artifact is thought to be intrusive.

Four features had non-Clemson Island diagnostic artifacts in them. Feature 5 contained a Poplar Island projectile point, and Features 6, 6A, and 10 all contained shell and grit tempered ceramics. Feature 31 contained a Susquehanna broadspear. Four intact features contained Clemson Island ceramics and no other diagnostic artifacts.

Figure 28 is a map of all 1 m units excavated to test the potential occupation or living surfaces from the Contact, Clemson Island, and Late Archaic components. The map is keyed to show units which contained artifacts from two or more of the occupations in the same 10 cm level. The majority of the units contained diagnostic artifacts from only the Clemson Island occupation, but a number contained artifacts from other occupations mixed together. With one exception, all of the units which contained artifacts from the Contact Period also had Clemson Island artifacts in the same level. The eight units which produced artifacts from the Late Archaic occupation also had Clemson Island artifacts in the same level. One unit, N82W66, had artifacts from the Contact, Clemson Island, and Late Archaic Periods in one 10 cm level. Shenks Ferry ceramics were also found in a level with Clemson Island ceramics, in Unit N79W50.

A consideration of the diagnostic artifacts in both features and test units from the Contact through Late Archaic occupations of the West Water Street Site clearly indicates that post-depositional movement of artifacts has taken place. In features, this movement has resulted from four actions: 1) the disturbance of the feature soils from natural processes such as rodent and

root action, 2) the disturbance of the features from modern/historic construction and filling, 3) the disturbance of the features from other later, intrusive features, and 4) the intrusion of the features into earlier artifact deposits. A total of 55 features at the site have been disturbed by natural processes or intrusive features, and 38 features have been determined to be disturbed by the presence of earlier diagnostic artifacts, or a mix of diagnostic artifacts from different cultural periods. As previously mentioned, all of the non-Contact features at the site are assumed to relate to the Clemson Island occupation, but features which contain diagnostic artifacts from other periods may relate to those periods. In addition, features without diagnostic artifacts may be from any of the Contact through Late Archaic occupations. It must be stressed that interpretations of the contents of features, exclusive of the diagnostic artifacts, are limited and tenuous at best, and great caution must be exercised. This same caveat applies to artifacts recovered from test units. Although only historic and natural artifact disturbances have occurred in these areas, a large amount of artifact mixing has still taken place, and artifact associations must be considered suspect.

CONTACT COMPONENT EXCAVATION RESULTS

Test Unit Excavations

Phase III excavations began at 36CN175 with the investigations of the Contact component in Segment 3. An area from N78W48 and N86W48 west to N86W70 and N78W70 was stripped of its historic topsoil and fill to an approximate depth of 20 to 30 cm below ground surface through the use of a mechanical excavator. Ninety-four 1 m x 1 m test units were then excavated in this area (Figure 28).

As previously mentioned in this report, the context of the Contact component was found to be highly disturbed. Therefore, only certain artifacts found during Phase III test unit excavations could be clearly associated with the Contact Period. These include European manufactured glass trade beads, flaked olive bottle glass, and Native American-manufactured beads and pipe fragments. Artifacts such as gun flints, lead shot, ball clay pipe fragments with no maker's marks, unworked olive bottle glass sherds, and miscellaneous brass buttons and fragments, although commonly associated with Contact occupations across Pennsylvania, cannot be positively attributed to the Contact component due to the highly disturbed nature of the soils. These aforementioned items were also used by settlers through the latter part of the eighteenth century and well into the nineteenth century and may be related to a local occupation of these times such as Fort Reed (Vento and Fitzgibbons 1989:604). Some artifacts from the Historic Period such as modern glass and coal ash, and many artifacts from earlier prehistoric periods, such as Clemson Island ceramics and Late Archaic Susquehanna broadspears, were often found in the same levels as Contact

TABLE 7

Contact and Possible Contact Artifacts Recovered from Test Units

Contact Artifacts

Beads	Count
WIb12	10
WIb5	1
WIb15	1
WIIc11	2
WIIc3	1
WIIc1	1
Ia18	1
lead bead	1
catlinite bead	1
Total	19

Other Contact Artifacts	Count
flaked olive bottle glass	1
effigy pipe bowl fragment	1

Possible Contact Artifacts

Type	Count
unflaked olive bottle glass	18
lead shot	9
gunflints	3
gunflint chips	2
European pipe stem fragments	17
European pipe bowl fragments	8
brass kettle fragments	4
brass buttons	2
iron axe head	1

TABLE 8

Trade Bead Typologies and Descriptions of Beads Found in Test Units and Features

Kidd	Kent	Fogelman	Description
Drawn			
Ia4	C11	---	white, tubular
Ia18	B5	---	blue,tubular
IIa58	---	---	red, round
IIa11	C13b	---	white, seed
IIa27	E14	---	green, seed
IIa53	B15b	---	blue, seed
---	---	IIa?13	blue, seed
IIa6	F12	---	black, seed
Wire Wound			
WIb5	C28	---	pale blue, round
WIb4	B28	---	opal, round
---	---	WIb?8	clear, round
WIb7	D28	---	amber, round
WIb12	---	---	light blue, round
WIb15	---	---	blue, round
WIIc1	F29	---	black, facetted
WIIc3	---	---	opal, facetted
WIIc11	B29a	---	blue, facetted

References: Kidd & Kidd 1970, Kent 1984, Fogelman 1991

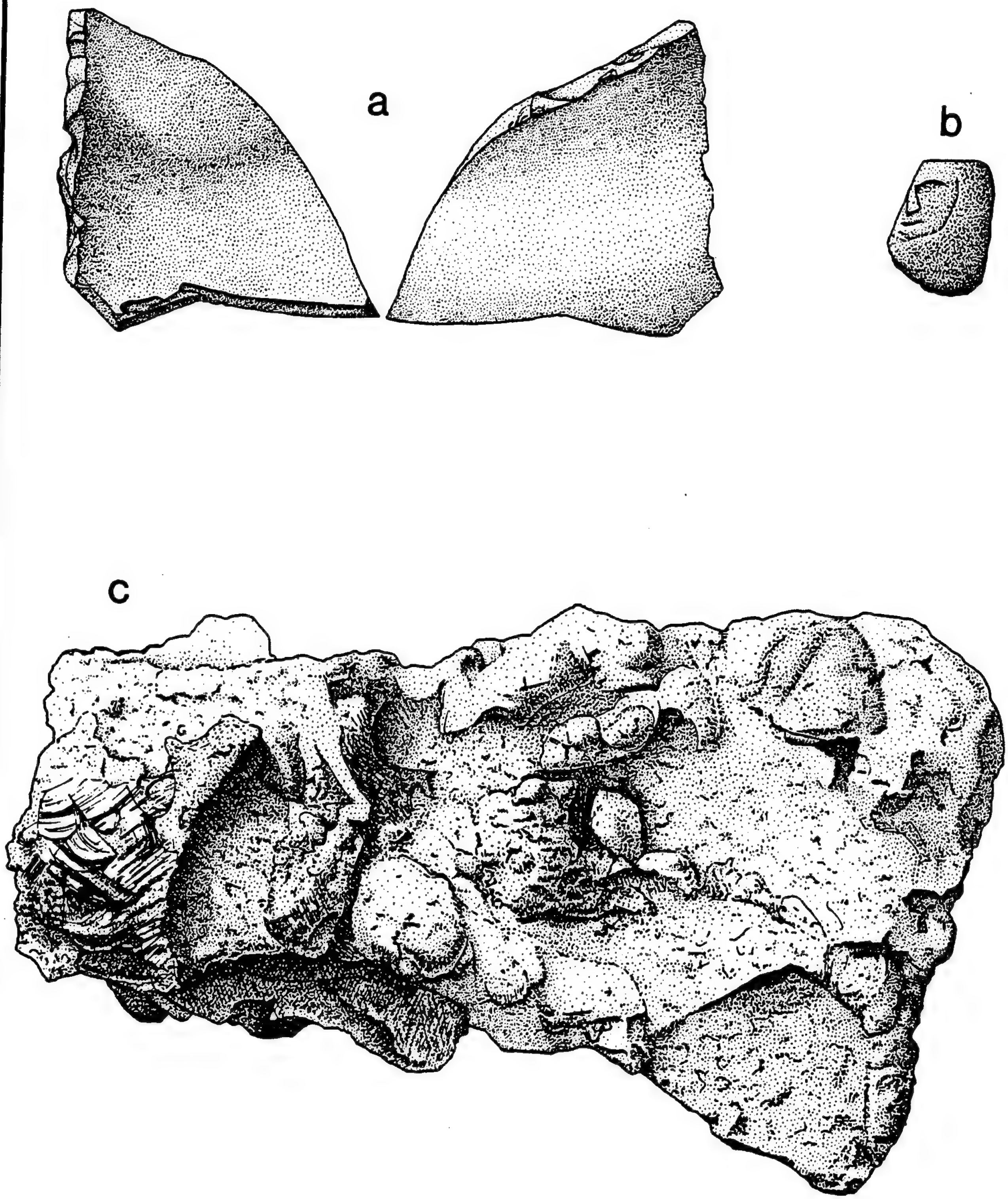
artifacts. All Contact artifacts and probable Contact artifacts from Phase III test units are listed in Table 7.

No Contact features were identified during test unit excavations. Intact features were identified and excavated outside of the Contact test unit area in Segment 3 and also in Segment 1. These features will be discussed following the description of Phase III Contact test unit excavations and artifacts.

<u>Beads</u>. A total of 17 glass trade beads of European manufacture were found during test unit excavations. The vast majority of these beads were wire-wound types. Ten round, blue beads (WIIb12; Kidd and Kidd 1970) were found. Table 8 shows the bead types of Kidd and Kidd (1970), Kent (1984), and Fogelman (1991) with descriptions of the beads found at this site. From here on in this report, bead types will be of the Kidd and Kidd (1970) classification unless otherwise noted. Two fractured, blue, faceted WIIc11 beads were recovered. One opal, faceted bead (WIIc3) and one black, faceted bead (WIIc3) were found. One

FIGURE 29

Selected Artifacts from Contact Period Test Units



a: N82 W70, Level 1; Worked olive bottle glass scraping implement.
b: N79 W69, Level 2; Human effigy pipe bowl fragment of native manufacture.
c: N82 W69, Level 2; Iron trade axe.

1 inch
1 cm

blue, round bead (WIb15) and one pale blue, round bead (WIb5) were found. Only one drawn bead, a blue, tubular bead (Ia18) was recovered during test unit excavation. All of the beads found in the test unit excavation generally date to the first half of the eighteenth century (Kent 1984:213).

In addition to these glass trade beads, two other beads were found: one modified lead shot bead and a catlinite bead. The lead bead appears to be a flattened and drilled piece of lead shot. It has an overall diameter of 7 mm. This bead is an enigma as no other references to such bead types at any Contact site in Pennsylvania could be found. This bead, however, is not unexpected because Native Americans were know to modify European goods into items more useful or desirable to them (Karklins 1992). For example, brass kettles were modified into a variety of adornments or projectile points (Kent 1984:203). One trapezoidal catlinite bead was found during unit excavations. This bead is 20 mm wide, 19 mm long, 5 mm thick and is drilled longitudinally. This bead is similar to beads found at the Conoy Cemetery (36LA40) and Conestoga Town (36LA52) (Kent 1984:168). Also, trapezoidal catlinite ornaments were found in two burials at the Park Site (36LA96) (Kinsey and Custer 1982).

<u>Olive Bottle Glass</u>. Nineteen pieces of olive (dark green) bottle glass were found during the excavation of the Phase II contact units. These sherds appear to be fragments of globular-bodied liquor or wine bottles most likely of English origin (Hume 1969:60-71). The sherds are predominantly from the body of the bottle, though several shoulder and neck pieces were identified. No kick-up, lip, or seal fragments were identified. Only one bottle fragment showed signs of intentional chipping. This piece, a globular-bodied body sherd, was worked on two edges into a scraping implement (Figure 29a). The sherd was 75 mm long, 48 mm wide and had worked surfaces, that were 18 mm and 15 mm long. All the glass sherds showed some patination.

<u>Gunflints and Lead Shot</u>. Three gunflints and two flint flakes were recovered from the Contact test units. One of the gunflints is gray, one is black, and the third is tan or pale brown. Both flakes are of black flint. All three intact flints are spall or wedge-shaped gunflints and are European in origin. They all show signs of use on the striking edges. Both the gray and the pale brown gunflints have resharpening wear as well. The flint flakes show no signs of utilization. Whitthoft (1966:25) notes that the wedge-shaped gunflint type appeared in the seventeenth century and were obsolete by 1770 with the introduction of prismatic gunflints. Kent (1983a:38) states that the wedge-shaped gunflints were the predominate type in North America for the first three quarters of the eighteenth century.

Nine pieces of lead shot were found during test unit excavation. These include three balls, four shot, and two ball fragments. One ball is intact and has a diameter of .54-.60" (14.1-15 mm). The other two balls are deformed but have approximately the same diameter as the intact ball. The shot

ranges in size from 5 mm to 7 mm and are all slightly deformed. The ball fragments are too deformed to be measured.

European Pipe Stems and Bowl Fragments. The Contact units yielded seventeen pipe stem fragments and eight bowl fragments. No decorated bowl fragments were found. Only one stem had a maker's mark. On one side of this stem, in a rectangular box are the letters 'GLAS.' The remainder of the stem is fractured after the 'S.' This undoubtedly refers to Glasgow, Scotland (Hume 1969:305). The reverse side of the stem contains the letters 'DSON' which are most likely the last four letters of the maker's name: "Davidson." These letters, too, are contained in a rectangular box. Alexander (1983:222-23) identifies several pipe stems from the Caleb Pusey House, Delaware County, Pennsylvania, that bear the maker's name "Davidson" and place of manufacture, "Glasgow." He dates these stems from 1861-1900. Therefore, the marked pipe stem recovered during Contact test unit excavation is a late nineteenth century artifact and indicates a mixing of Contact and later Historic Period artifacts within the same soil. No other decorated or marked stems were found.

Pipe stem bores were measured and dated using Harrington's (1954) clay tobacco pipe stem chart. A mean date was derived from the sample by using Binford's (1961) straight line regression formula. The mean date derived from this sample was A.D. 1752. It must be remembered, however, that this was a very small sample of pipe stems and at least one post-Contact Period pipe stem is included in the sample. This mean date is therefore questionable.

Native Pipe Fragments. One native pipe fragment of the Contact Period was recovered during unit excavations. This pipe fragment is a remnant of a effigy pipe bowl. The effigy is that of a human face and is illustrated in Figure 29b. The bowl type is unclear, though it does resemble pipe bowls of European manufacture. The clay is light brown and appears to be tempered with a very fine grit. Both the exterior and interior surface of the bowl fragment are dark brown. The effigy face is fractured; the left eye and left forehead portions are missing. The intact portion of the effigy consists of a round, highly stylized face with a heavy brow and a deep, hollow eye socket. The nose is large and triangular and is connected to the brow/eye socket. The mouth is a nondescript, small, straight slit just below the nose. Two short parallel lines have been incised on the face just below the right eye. The lines angle down away from the right eye at the same angle as the right side of the nose angles down from the brow. The estimated diameter of the effigy is 17 mm.

Brass Items. Four brass kettle fragments were found in Contact Period test units. These fragments were small (no longer than 5 cm) and were unmodified.

Two buttons were among the brass items found. These include a round, cast button with an undecorated face. The eye is missing, but the foot is intact. The face is plain (no

decoration) and rounded. The button has a diameter of 25 mm. The second button/boss is flat faced with a hand-cut floral motif. This button/boss appears to have been hand-cut from a round, flat disk button as the shape is crude and uneven. Engraved (cut) lines on the face that define the flower's 'petals' are very crude. This may be a button or a boss possibly used as a leather fastener.

Iron Trade Axe. One iron trade axe was found in Level 2 of unit N82W69 directly on top of a Clemson Island feature filled with burned corn cobs (Figure 29c). The axe is clearly unrelated to the aforementioned feature. The axe is very corroded, and it measures 6 1/4" (15.9 cm) long with a 3 1/2" (9 cm) cutting edge. The eye is tear-drop shaped and has an eye length/width ratio of 1.7 to 1. Eye height is 1 7/8" (4.8 cm). The axe weighed 862 g. These characteristics resemble those of the axes from the Strickler Site (36LA3) which dated from 1645 to 1665 (Kent 1984:235). It is not unreasonable to think that this axe dates from that period and was subsequently used for several decades before it was deposited at this site sometime in the first half of the eighteenth century.

Nails. A number of very corroded nails were recovered from the Contact test units. These nails were too rusted to determine if they were older wrought nails or post-Contact Period cut nails.

Contact Features

The following is a description of the Contact Period features excavated during Phase III data recovery at the West Water Street Site. After the mechanical stripping of historic fill from Sections 1 and 3, a total of five Contact features were identified and excavated. These included Features 19, 81A, 107, 497, and 531. These five features were all located in Section 3 (Figures 26 and 27). Also, Contact artifacts were recovered from Features 11, 13, 42 and 66, 104 and 129 in Section 3, and from Features 235 and 575 in Section 1, but these artifacts are thought to be intrusive Contact artifacts in Clemson Island features.

Feature descriptions will include feature shape and dimensions, along with a listing and description of the recovered artifacts. Tables 9 and 10 list the European (Non-Native) manufactured and Native-manufactured artifacts recovered from the Contact features. Finally, each feature description will contain an analysis of possible feature function.

Feature 19. Feature 19 was an unstratified, circular pit feature with steep sides, a flat bottom, and a depth of approximately 28 cm below the machine-stripped surface (the bottom of the historic fill). The feature diameter was 75 cm (Figure 30). The feature fill was a brown silty loam with carbon flecks. Contact (European) items recovered from Feature 19 include an undecorated, unmarked ball clay pipe stem fragment, an

TABLE 9

Artifacts from Contact Features 19, 81A, 107, and 497

Feature #	European Manufacture	Native Manufacture
19	1 - ball clay pipe stem fragment 1 - olive bottle glass flake 1 - gunflint chip 1 - brass ring band fragment (undecorated) 3 - lead shot pieces 2 - white glass seed beads (IIa11.Kidd)	4 - chert flakes 4 - jasper flakes 5 - rhyolite flakes 1 - quartz spoke shaver 1 - mortar & pestal set 1 - hammerstone 13 - fire-cracked rocks (weight = 881g)
81A	2 - ball clay pipe stem fragments 1 - olive bottle glass sherd 1 - facetted, pale blue/opal glass bead (WIIc3.Kidd)	1 - chert triangle projectile point 1 - chert biface fragment 1 - jasper flake tool 2 - quartzite flakes 44 - chert flakes 1 - jasper flake 1 - rhyolite flake 1 - argillite flake 18 - fire-cracked rocks (weight = 904.5g)
107	3 - unmodified olive bottle glass sherds 1 - utilized olive bottle glass sherd 1 - modified olive bottle glass scraper 2 - spall gunflints (European flint) 1 - unidentified corroded iron object 2 - white glass seed beads (IIa11.Kidd)	6 - quartzite flakes 2 - quartz shatter 48 - chert flakes (including 4 utilized flakes and 1 chert flake tool) 4 - jasper flakes (including 2 utilized flakes) 5 - rhyolite flakes 1 - chert late-stage biface reject 6 - sherds of Shenks Ferry ceramic 2 - unidentified ceramic sherds 1 - net sinker 42 - fire-cracked rocks (weight = 2004g)
497	1 - olive bottle glass sherd 1 - white glass seed bead (IIa11.Kidd) 1 - blue glass seed bead (IIa?-13.Fogelman) 1 - nail (intrusive) 1 - copper sheeting fragment (intrusive)	2 - quartzite flakes 2 - jasper flakes 7 - rhyolite flakes 22 - chert flakes (including 2 utilized) 2 - unidentified ceramic sherds 4 - fire-cracked rocks (weight = 1281g)

olive bottle glass flake, a brass ring fragment (no bezel, no decoration), a gunflint chip, and three pieces of lead shot. The smaller pieces of lead shot had a diameter of approximately 5-6 mm and were not deformed. The larger piece was deformed but appeared to have an approximate diameter of 0.54 to 0.60" (14.1-15 cm). Two white seed beads, (IIa11), were recovered from flotation samples.

Non-European (Native) items found in this feature include four chert flakes, four jasper flakes, five rhyolite flakes, a quartz spoke shaver, a mortar and pestal, a hammerstone, 13 pieces of fire-cracked rock (weight 881 g), and two small, unidentifiable prehistoric ceramic sherds. Also, many tiny bone fragments were found in the feature fill. These fragments were all very small and preservation was poor, hence, the species

TABLE 10

Artifacts Recovered from Contact Burial Feature 531

Beads

Provenience	Ia18	Ia4	WIIc11	WIIc1	WIb7	IIa?13	WIb5	WIb4	IIa11	WIb?8	IIa58	IIa6	IIa53	IIa27
group 1	58	41	--	--	--	1	2	--	3	1	10	--	--	--
group 2	--	--	--	--	--	--	--	2	--	--	--	--	--	--
general fill	5	3	1	1	1	1	--	--	8	--	--	--	--	--
group 1-flotation	2	--	--	--	--	--	--	--	1	--	3	--	--	1
group 2-flotation	--	--	--	--	--	--	--	--	--	--	--	--	--	--
general fill-flotation	--	--	--	--	--	1	--	--	--	--	--	2	1	--
Total	65	44	1	1	1	3	2	2	12	1	13	2	1	1

Total all beads 149

Other European Items

Provenience	Brass Rings	Pipe Bowl Fragment	Lead shot	Jew's Harp	Misc. Brass Fragments	White Glass Fragment	Leather
group 1	15	--	1	1	--	--	1g
group 2	--	--	--	--	2	--	--
general fill	--	1	3	--	--	1	--
group 1-flotation	--	--	1	--	4	--	--
group 2-flotation	--	--	--	--	--	--	--
general fill-flotation	--	--	1	--	--	--	--
Total	15	1	6	1	6	1	1g

Native Items

Flake and Flake Tools

Provenience	Chert	Jasper	Rhyolite	Quartzite	Siltstone	Chert Utilized	Quartzite Utilized	Jasper Utilized	Chert flake tool
group 1	52	2	1	1	--	3	--	--	--
group 2	12	--	--	--	--	1	--	--	--
general fill	154	24	13	--	7	4	--	1	1
group 1-flotation	65	4	1	--	--	--	--	--	--
group 2-flotation	14	4	--	--	--	--	--	--	--
general fill-flotation	245	18	1	1	--	--	1	--	--
Total	542	52	16	2	7	8	1	1	1

Other Native Items

Provenience	Catlinite Bead	Clemson Island Ceramics	Shenks Ferry Ceramics	Unidentified Ceramics	Chert Triangle Point	Chert Biface	Rhyolite Biface	Steatite Fragment	FCR	Chert Scraper
group 1	--	6	--	--	--	--	--	1	2	1
group 2	--	3	1	6	--	--	--	--	1	--
general fill	1	24	8	39	1	2	1	--	8	--
group 1-flotation	--	--	--	2	--	--	--	--	--	--
group 2-flotation	--	6	--	7	--	--	--	--	--	--
general fill-flotation	--	9	--	3	--	--	--	--	--	--
Total	1	48	9	57	1	2	1	1	11	1

FIGURE 30

Plan View and Profile of Feature 19

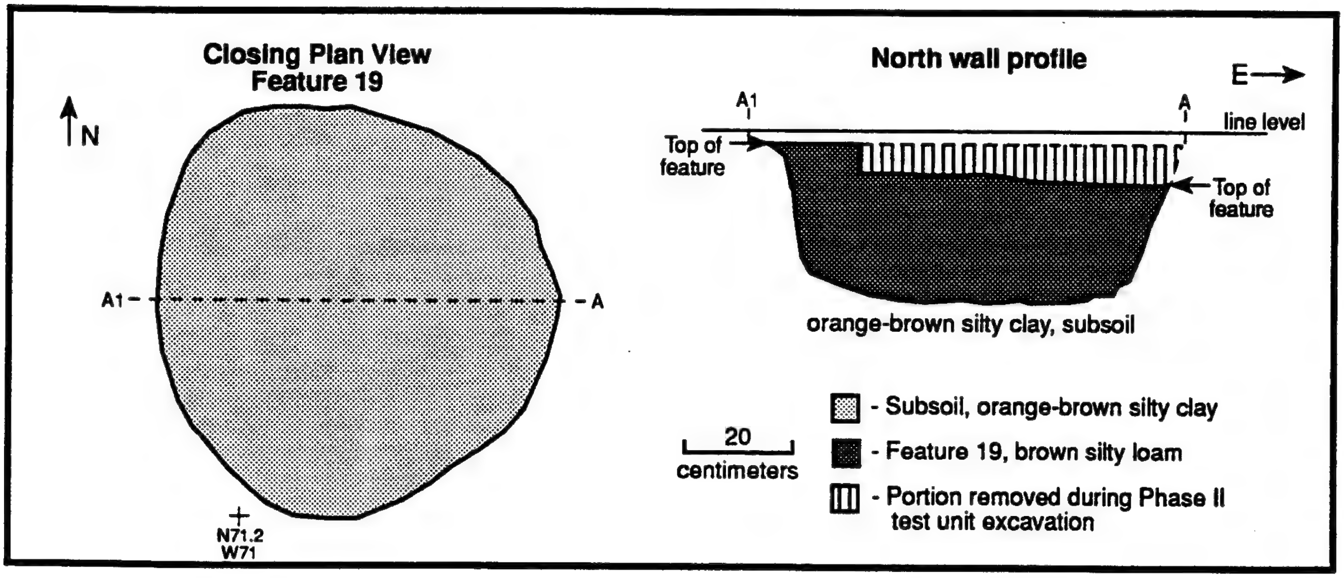
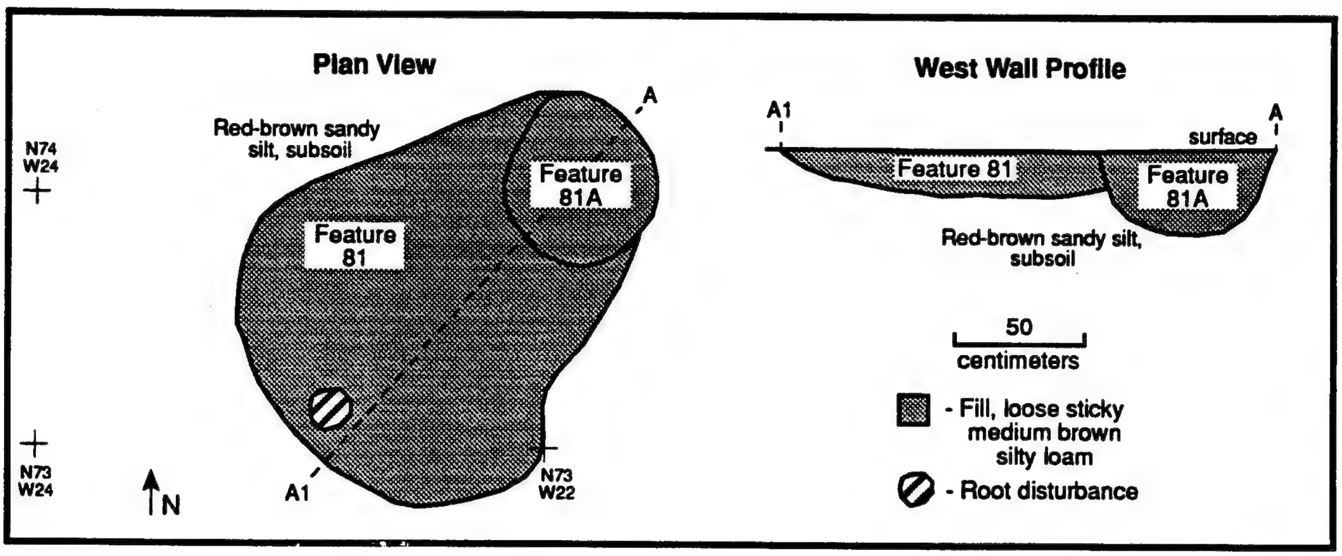


FIGURE 31

Plan View and Profile of Feature 81A

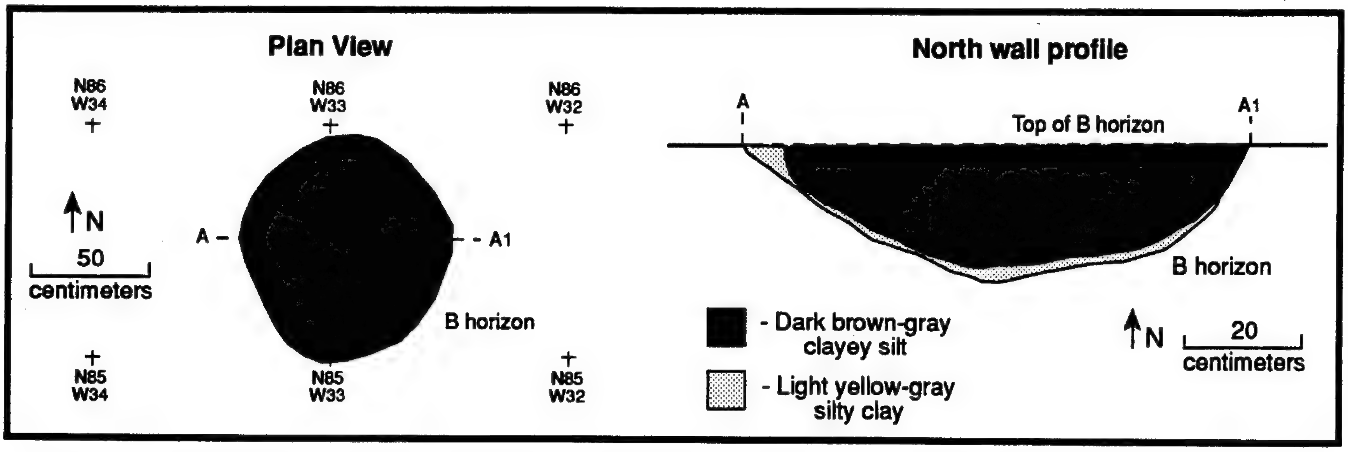


could not be identified. However, some of the bone chips were burned. In addition, carbon flecking was noted throughout the feature soil.

Feature 19 appears to be a refuse pit. The presence of burnt bone and carbon, plus the abundance of fire-cracked rock, suggests that this is the refuse of the food preparation process. The haphazard scattering of artifacts within this feature suggests that they came to be in the pit in a random fashion. It must also be mentioned that a late nineteenth to early twentieth

FIGURE 32

Plan View and Profile of Feature 107



century porcelain insulator was found in this feature. This is an intrusive artifact and no other post-Contact Period artifacts were found in this feature.

Feature 81A. Feature 81A was a small, round, feature with steep, sloping walls and a round bottom (Figure 31). The feature diameter was approximately 65 cm and its depth was approximately 35 cm below the machine-stripped surface. Feature 81A intersects a larger Clemson Island feature (Feature 81) and, in fact, cuts clear through Feature 81. The soil of Feature 81A was a medium brown silt loam.

Items of European origin include two unmarked pipe stem fragments, a very small piece of heavily patinated olive bottle glass, and one faceted, pale blue-opal trade bead (WIIc3). Native artifacts include a chert triangle projectile point (tip missing), a chert biface fragment, a jasper flake tool, two quartzite flakes, 44 chert flakes, one jasper flake, one rhyolite flake, one argillite flake, 18 pieces of fire-cracked rock (total weight 904.5 g), nine Clemson Island ceramic sherds, and nine unidentifiable prehistoric ceramic sherds. In addition to these artifacts, a large number of very small bone fragments were found. These bone fragments were unidentifiable.

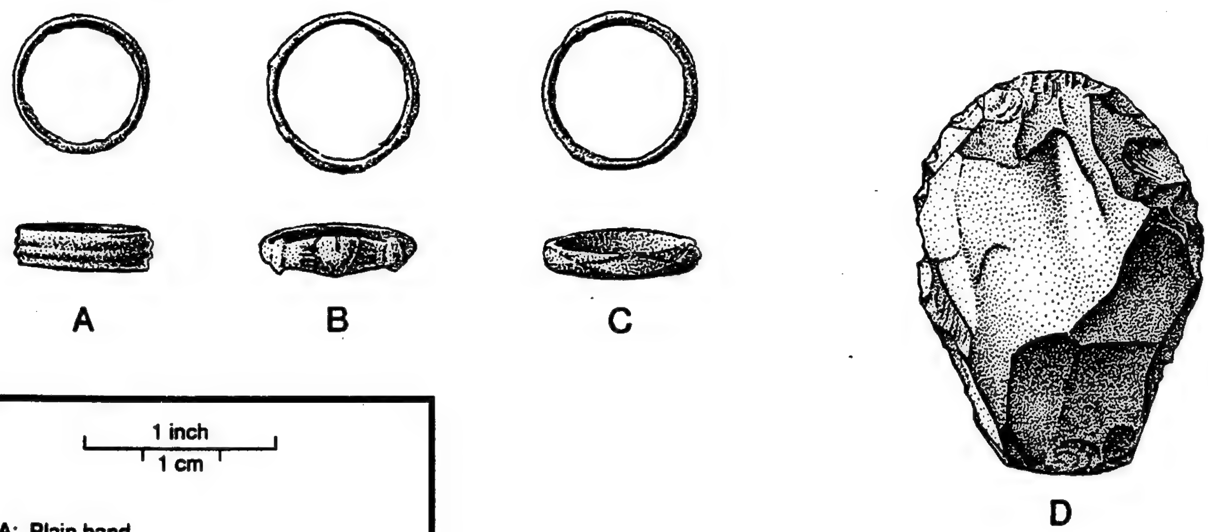
Carbon flecking was noted throughout the feature fill. As in Feature 19, the fire-cracked rock and artifacts show no semblance of order and appear to have been randomly placed in the pit. Again the carbon and bone fragments indicate food preparation and are probably the refuse of that process. Many aspects of Feature 81A resemble those of Feature 19, and like Feature 19, Feature 81A is most likely a refuse pit.

Feature 107. Feature 107 was a circular, unstratified feature with sloping walls and a round bottom (Figure 32). The feature diameter was approximately 90 cm and its depth below the machine-stripped surface was 20 cm. The feature fill was a homogeneous gray brown clayey silt. European manufactured Contact items found in Feature 107 include five olive bottle glass fragments including a utilized fragment and a sherd heavily

FIGURE 33

Selected Artifacts from Contact Period Features

Brass ring types from Feature 531, Contact Period burial



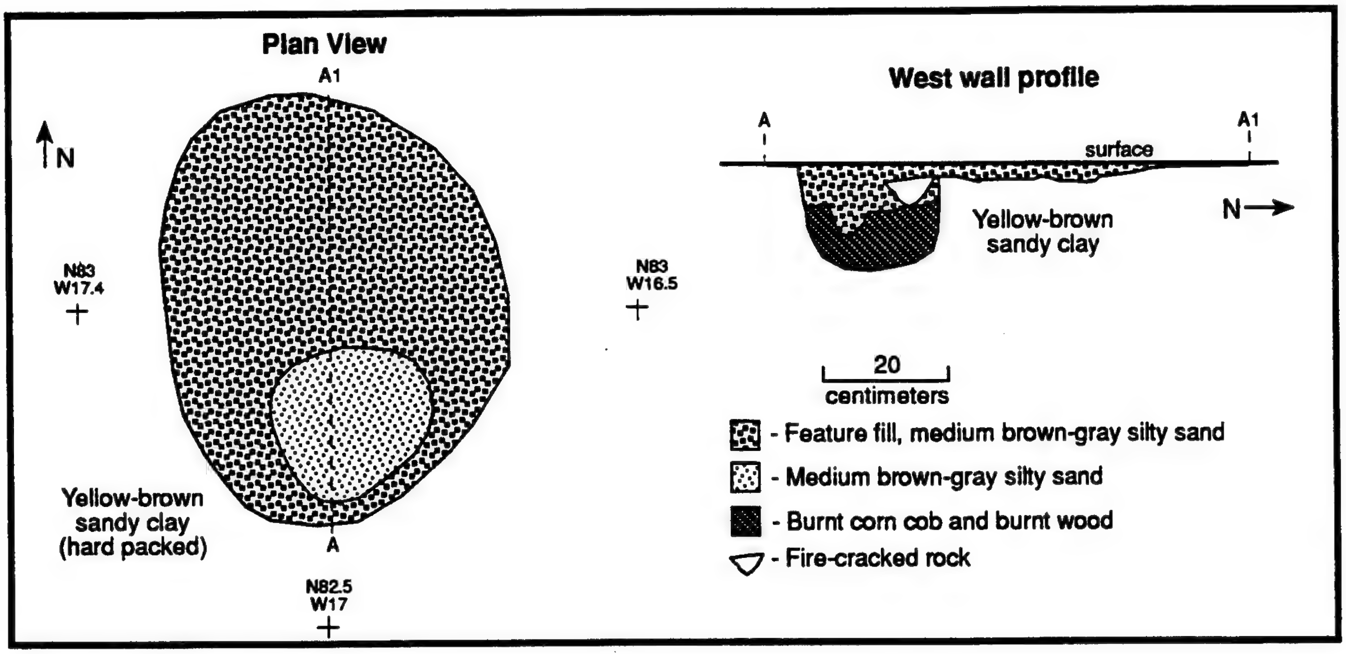
A: Plain band.
B: Claddagh ring.
C: Diamond pattern band.
D: Feature 107; olive bottle glass scraper.

worked into a large scraper (Figure 33d). Also found were two spall or wedge-shaped gunflints made from European flint. Both show signs of heavy use on the striking edges. One highly corroded ferrous object was recovered. This artifact is most likely a very rusty nail, but positive identification is impossible. Two white seed beads (IIa11) were recovered from flotation samples.

Artifacts of native manufacture include numerous lithic flakes, six utilized flakes, a chert flake tool, a chert biface reject, six sherds of Shenks Ferry ceramic, two unidentifiable sherds, a net sinker, and 42 pieces of fire-cracked rock (weight 2004 g). Also, a nondescript steatite fragment was found. This fragment was too small to be clearly identified as a steatite bowl fragment, although other steatite bowl fragments were found in features at the site. As in Feature 19 and 81A, carbon flecks and bone chips were found. Feature 107 also appears to be a refuse pit.

Feature 497. Feature 497 was an oval shaped, shallow, Contact Period feature that overlaid a Clemson Island post feature filled with burnt corn (Figure 34). The Contact portion of the feature ranged in depth from 2 to 12 cm below the machine-stripped surface and appeared to have been truncated, possibly by modern construction and landscaping. The deeper portion was located directly over the Clemson Island feature. The Contact portion of the feature was approximately 70 cm long and 55 cm wide, while the Clemson Island burnt corn-filled post feature was approximately 23 cm in diameter and was generally circular shaped. The Clemson Island feature was completely obscured by

FIGURE 34
Plan View and Profile of Feature 497



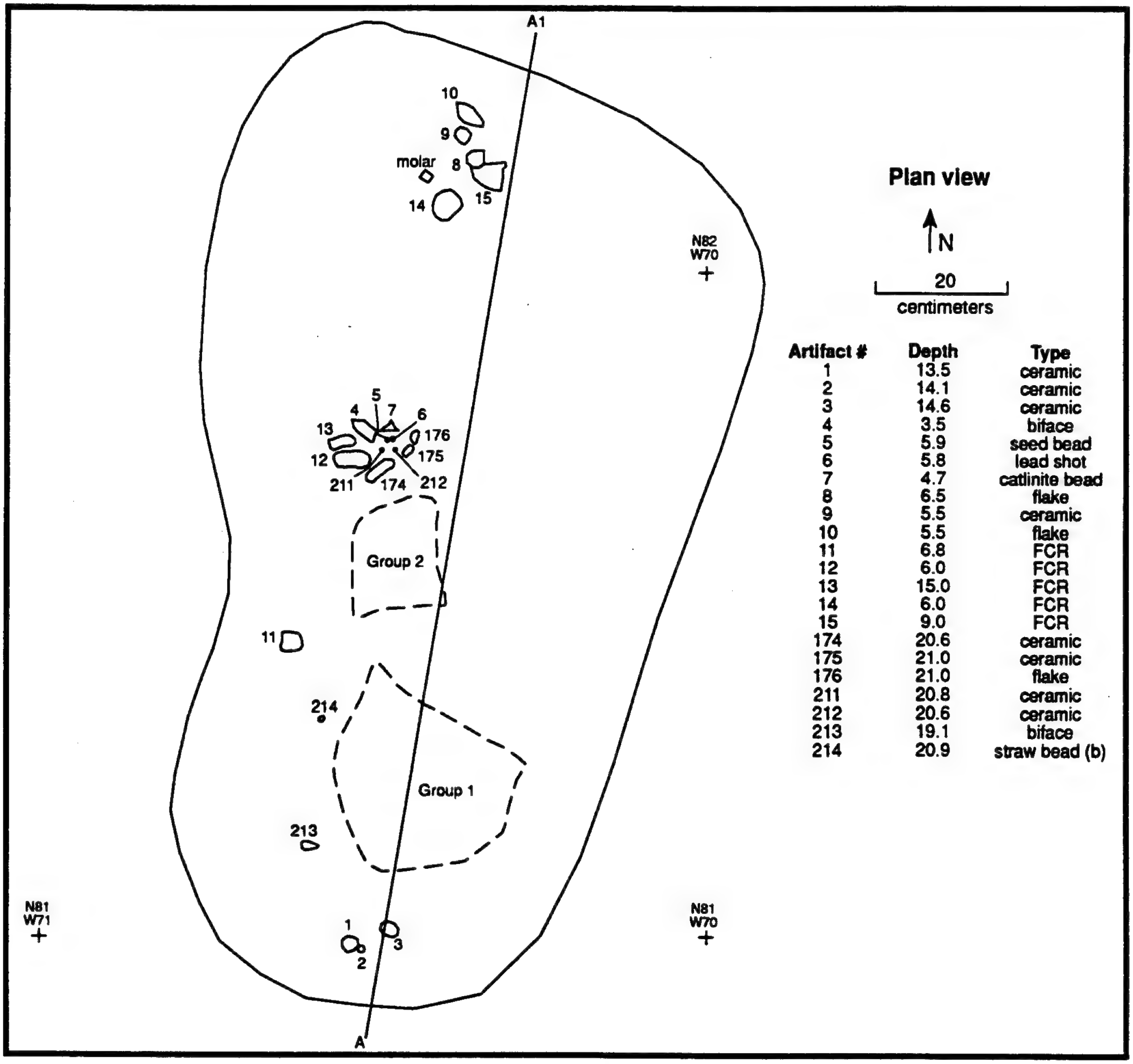
the Contact feature until the excavators removed nearly all of the Contact feature fill. The Clemson Island feature continued below the bottom of the Contact feature to a depth of 18 cm. Contact feature soil was a medium gray brown silty sand, while the Clemson Island fill consisted totally of burnt corn cobs and burnt wood.

Contact Period goods of European manufacture found in Feature 497 include one sherd of olive bottle glass and two glass seed beads. These include a white seed bead (IIa11) and a blue seed bead (IIa? - 13; Fogelman 1991). Also, two post-Contact artifacts were found in Feature 497. These artifacts, a highly rusted nail (unidentifiable) and a bent piece of thin copper sheeting metal, are intrusive.

Artifacts of native origin include debitage of chert, jasper, and rhyolite, three utilized chert flakes, and fire-cracked rock. Also, two sherds of unidentifiable prehistoric ceramic were found. Several tiny bone fragments were also found in the Contact fill. This feature may have been a storage/refuse pit, but this identification is difficult to substantiate, due to the feature's highly truncated state.

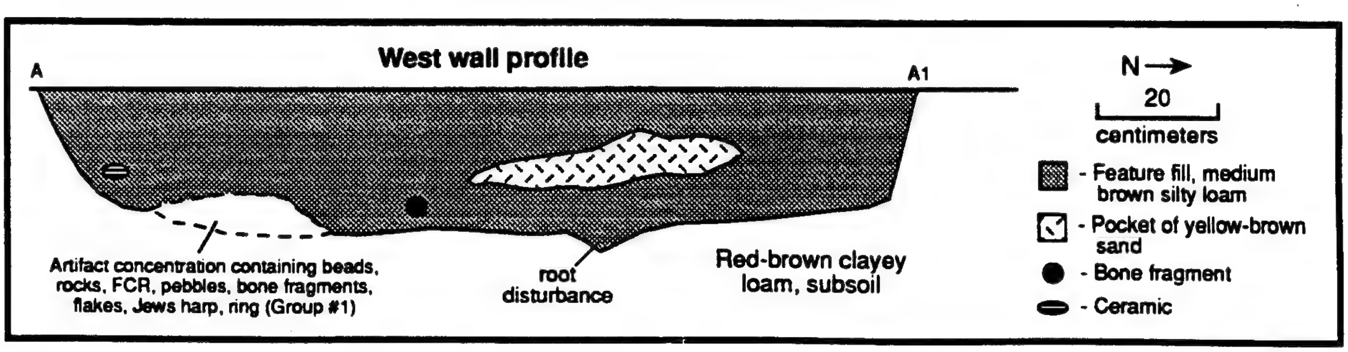
<u>Feature 531 - Contact Burial</u>. Feature 531, a Contact burial, was an irregular oval-shaped feature with steeply sloping walls and a flat bottom. The feature had an overall length of 143 cm and a width of approximately 70 cm. The maximum depth of the feature was 23 cm below the stripped surface. Figures 35 and 36 show the plan view and profile, respectively, of Feature 531. The feature fill was a homogeneous medium brown silt loam.

FIGURE 35
Plan View of Feature 531 Showing Artifact Groups



Artifact #	Depth	Type
1	13.5	ceramic
2	14.1	ceramic
3	14.6	ceramic
4	3.5	biface
5	5.9	seed bead
6	5.8	lead shot
7	4.7	catlinite bead
8	6.5	flake
9	5.5	ceramic
10	5.5	flake
11	6.8	FCR
12	6.0	FCR
13	15.0	FCR
14	6.0	FCR
15	9.0	FCR
174	20.6	ceramic
175	21.0	ceramic
176	21.0	flake
211	20.8	ceramic
212	20.6	ceramic
213	19.1	biface
214	20.9	straw bead (b)

FIGURE 36
Profile of Feature 531



The feature was identified as a Native American burial upon the discovery of a human molar. The burial was excavated and the human molar, excavated artifacts, and feature matrix were curated according to the human burial treatment plan developed by the Army Corps of Engineers.

Only one positively identifiable human remain was found in Feature 531. That remain was an unerupted third molar (upper) found at 3 cm below the feature surface and indicated a possible age of 15-21 years at the time of death. A full description and analysis of this molar is contained in the human osteology report contained in this text. Many tiny mammalian bone fragments were found throughout the feature, but these fragments were too small and deteriorated to be identified. No bone fragment concentrations or articulations were noted. None of the bone fragments appeared to be burned.

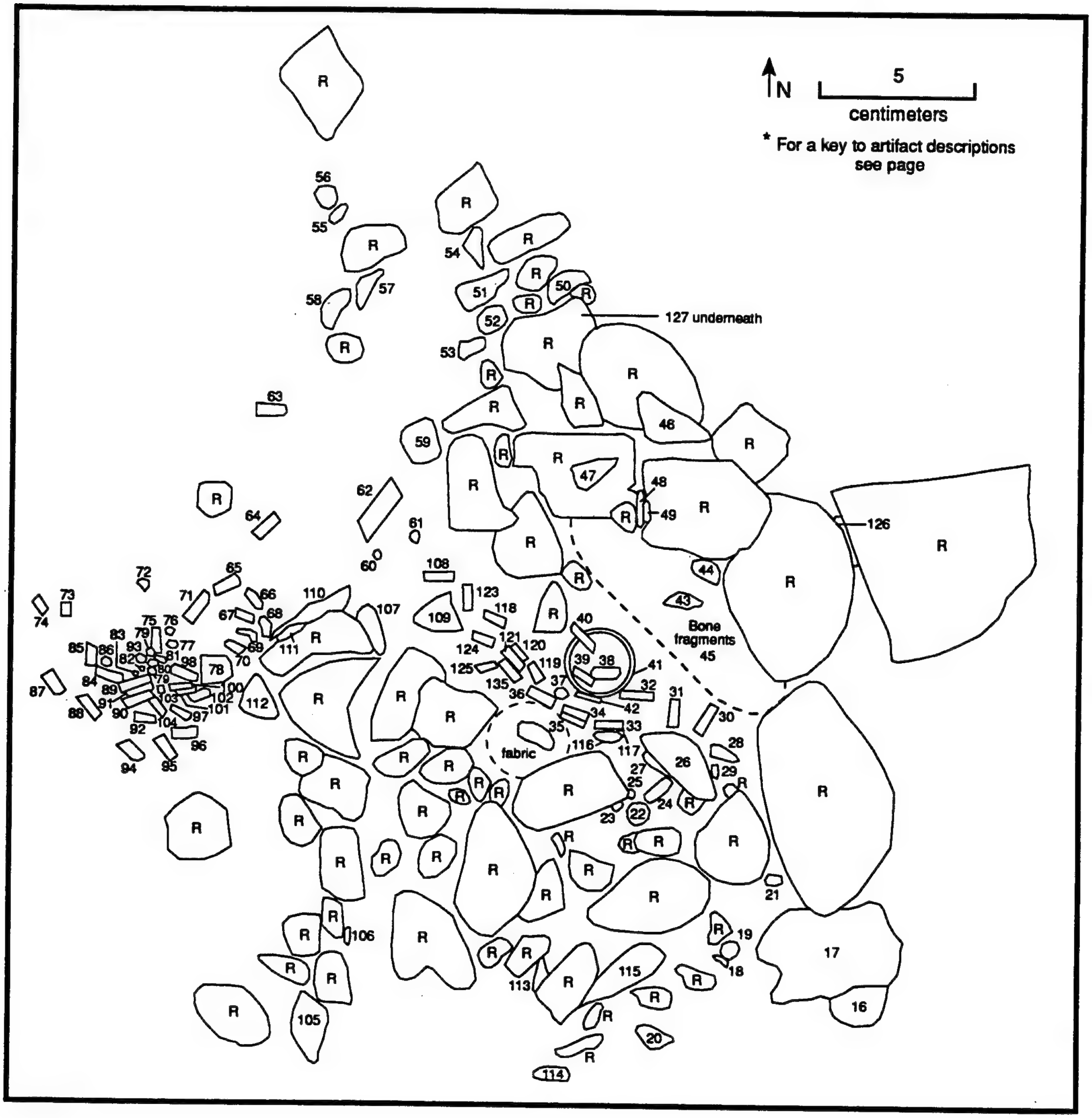
Artifacts, both of native and European manufacture, were found throughout the feature fill, although the majority of the artifacts were found in the bottom 7 cm of the feature, mainly in two concentrations. Table 10 lists all artifacts found during excavation and recovered from flotation samples. European-produced artifacts included numerous glass trade beads, brass rings, lead shot, a jew's harp, a ball clay pipe bowl fragment, and miscellaneous glass and brass fragments. Native goods consisted of lithic debitage, a triangle point, a catlinite bead, a clay effigy pipe bowl fragment, ceramic sherds of various types, and remnants of a leather pouch or garment.

Two artifact concentrations, Group 1 and Group 2, were noted during excavation of the burial (Figure 37). Group 1 was a dense group of stones, flakes, beads, rings, and other artifacts. The cluster was somewhat pentagonally shaped and measured approximately 25 cm long and 28 cm wide and was about 3.5 cm thick. Exact provenience excavation revealed a cluster of non-articulated beads, mainly blue and white tubular beads, on the western edge of Group 1 (Figure 37). In the center of Group 1 an assemblage of blue and white tubular beads were found that did appear to be articulated, as if they had been strung. Only a small number of beads (11) were clearly included in this articulation. It appeared that the beads were strung in two parallel sections. This may represent a doubled-over long string of beads or two separate strands, although this is only speculative. No color patterning was evident along the strings of blue and white beads. Also, no intact stringing materials were found amongst the beads.

Adjacent to the articulated beads, just to the north, a brass "Jesuit" ring was located. This ring had an octagonal bezel and the capital letter "M" was engraved upon it. According to Cleland (1972), the "M" engraving is a stylistic progression from an original Jesuit ring motif known as the "Double-M." This "Double-M" stood for the Latin words "Mater Misericordia" or "Mother of Mercy." Cleland suggests that the octagonal bezel phase of the Jesuit ring form is a manifestation of the first

FIGURE 37

Plan View of the Upper Portion of Artifact Group 1, Feature 531



half of the eighteenth century. Evidence from the French occupation of Fort Michilimackinac in Michigan, which dates from 1715 to 1760, supports this contention (Stone 1974).

After the upper portion of Group 1 was removed, more articulated blue and white tubular beads were uncovered (Figure 38). These bead articulations appeared to be continuations of

FIGURE 38

Plan View of Artifact Concentration - Group 1, Lower Portion, Feature 531

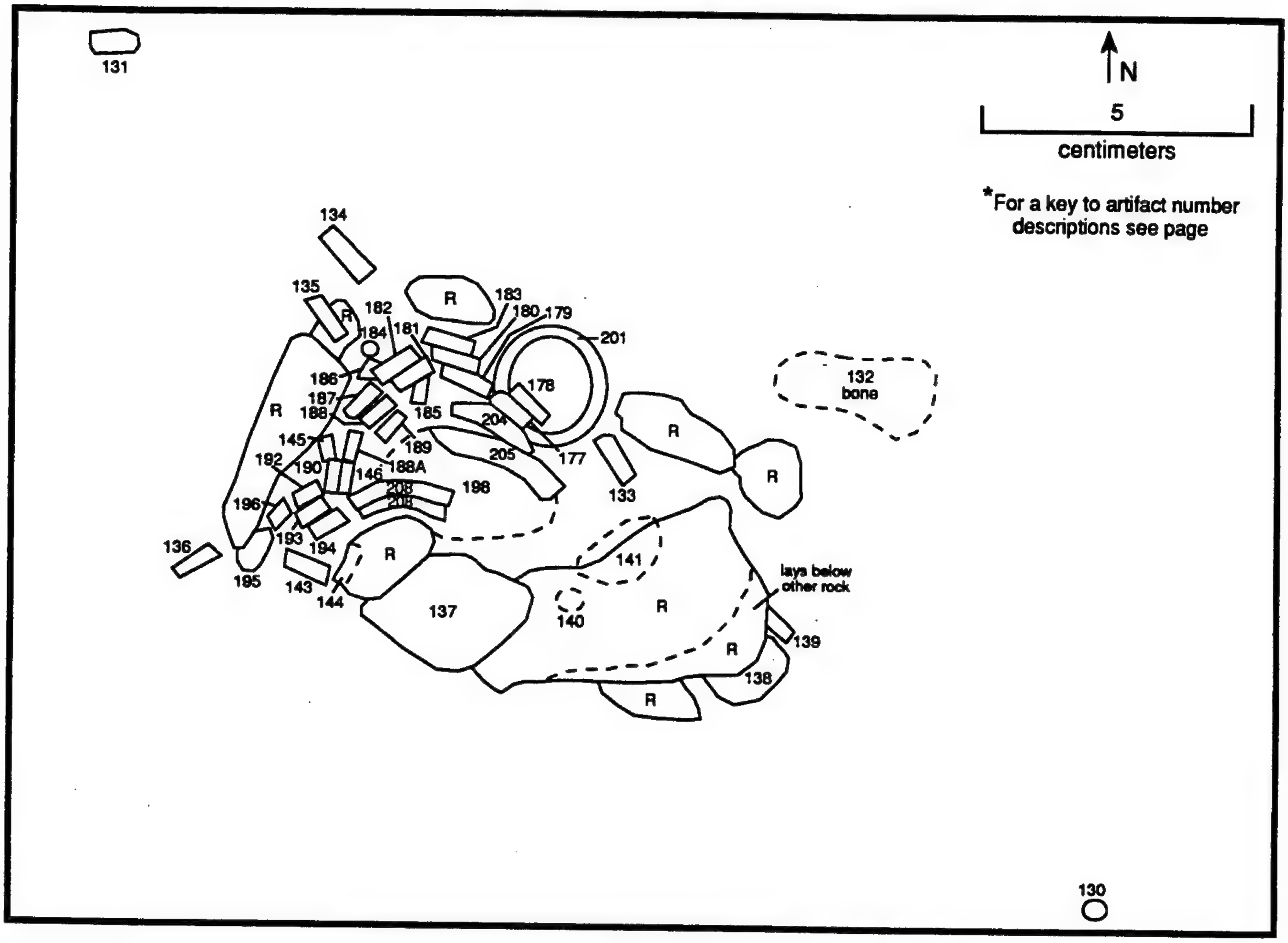
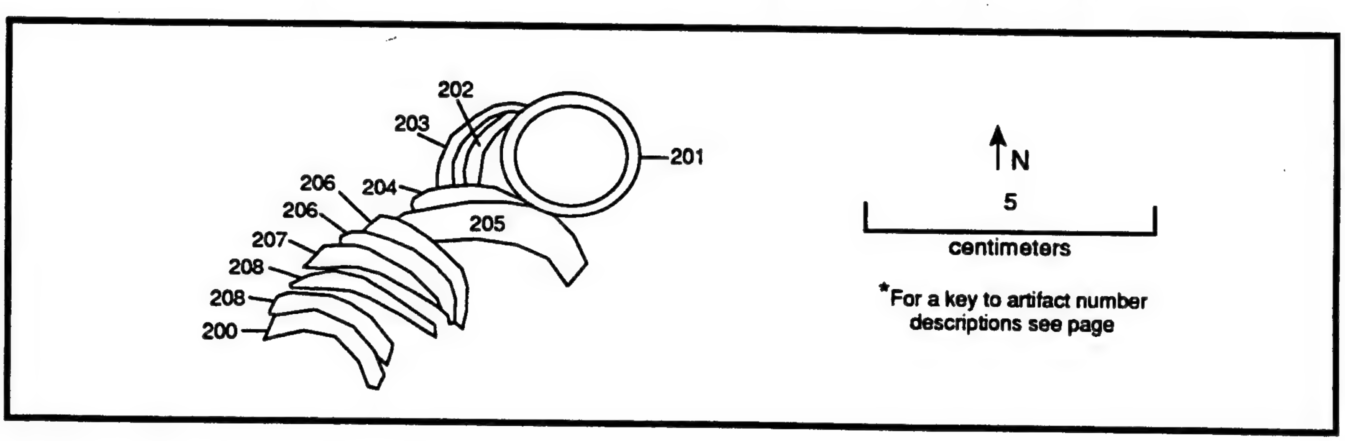


FIGURE 39

Ring Cluster, Artifact Group 1, Feature 531



Key to Figures 37, 38, and 39

Artifact #	Depth (cm)	Type	Artifact #	Depth (cm)	Type
16	18.0	Jew's harp	81	15.9	straw bead (w)
17	17.5	flake	82	16.2	straw bead (b)
18	18.0	flake	83	16.2	straw bead (b)
19	18.0	flake	84	15.8	straw bead (b)
20	17.5	flake	85	16.9	straw bead (b)
21	18.0	flake	86	16.7	straw bead (b)
22	16.3	glass bead	87	16.8	straw bead (w)
23	16.3	flake	88	16.9	straw bead (w)
24	16.0	straw bead (w)	89	16.4	straw bead (b)
25	16.8	straw bead (w)	90	16.4	straw bead (b)
26	16.0	flake	91	17.0	straw bead (w)
27	15.8	flake	92	16.8	straw bead (b)
28	16.5	straw bead (w)	93	17.2	bone
29	16.5	flake	94	16.5	straw bead (b)
30	17.0	straw bead (w)	95	16.4	straw bead (w)
31	17.0	straw bead (w)	96	17.9	straw bead (w)
32	16.5	straw bead (b)	97	17.7	straw bead (w)
33	16.0	straw bead (b)	98	16.7	straw bead (w)
34	15.5	straw bead (b)	99	17.0	straw bead (w)
35	15.5	straw bead (b)	100	16.9	straw bead (b)
36	16.0	straw bead (b)	101	17.0	straw bead (b)
37	16.0	flake	102	16.9	straw bead (b)
38	16.0	unidentified material	103	17.6	straw bead (b)
39	16.0	straw bead (w)	104	18.0	straw bead (b)
40	16.5	straw bead (b)	105	17.8	flake
41	15.8	ring	106	16.5	flake
42	16.2	straw bead (b)	107	16.7	flake
43	15.8	flake	108	15.7	straw bead (b)
44	15.5	flake	109	15.5	flake
45	15.6	bone	110	17.1	flake
46	15.9	flake	111	17.2	straw bead (b)
47	14.7	flake	112	15.0	flake
48	17.1	flake	113	16.3	flake
49	16.6	flake	114	16.9	ceramic
50	16.4	flake	115	17.0	flake
51	17.0	flake	116	16.0	straw bead (b)
52	17.2	flake	117	16.0	straw bead (w)
53	17.1	flake	118	16.0	straw bead (b)
54	16.8	flake	119	15.9	straw bead (w)
55	14.8	flake	120	15.9	straw bead (w)
56	17.0	flake	121	15.7	straw bead (b)
57	16.5	flake	122	16.1	straw bead (b)
58	15.2	flake	123	16.5	straw bead (w)
59	17.6	ceramic	124	16.0	straw bead (b)
60	17.2	seed bead	125	15.9	straw bead (w)
61	16.7	flake	126	18.1	glass bead
62	16.3	bone	127	17.0	straw bead (w)
63	18.2	straw bead (b)	128	18.8	straw bead (w)
64	16.4	straw bead (w)	129	18.7	straw bead (w)
65	16.3	straw bead (w)	130	19.1	lead shot
66	17.1	straw bead (b)	131	20.0	straw bead (b)
67	17.2	straw bead (w)	132	17.4	bone
68	17.1	straw bead (b)	133	16.6	straw bead (w)
69	17.9	straw bead (w)	134	17.5	straw bead (b)
70	17.2	straw bead (b)	135	17.2	straw bead (b)
71	15.7	straw bead (b)	136	17.7	straw bead (b)
72	12.7	straw bead (w)	137	16.2	ceramic
73	17.6	straw bead (w)	138	18.8	flake
74	17.3	straw bead (w)	139	18.9	straw bead (w)
75	15.5	straw bead (w)	140	18.2	bone - below a rock
76	15.5	straw bead (b)	141	17.5	flake - below a rock
77	16.0	straw bead (b)	142	17.6	flake - south and below artifact 205
78	16.2	flake	143	16.3	straw bead (w)
79	16.1	straw bead (b)	144	16.3	straw bead (b)
80	16.0	straw bead (w)	145	16.2	straw bead (w)

Key to Figures 37, 38, and 39, continued

Artifact #	Depth (cm)	Type
146	16.0	straw bead (b)
177	15.6	straw bead (b)
178	16.0	straw bead (w)
179	15.9	straw bead (w)
180	16.4	straw bead (w)
181	16.4	straw bead (b)
182	16.5	straw bead (b)
183	16.8	straw bead (b)
184	17.5	seed bead
185	16.4	straw bead (w)
186	17.5	flake
187	16.6	straw bead (b)
188 &188A	16.5	2 straw beads (b)
189	16.5	straw bead (b)
190	16.0	straw bead (b)
191	16.5	straw bead (b) - under artifact 190
192	16.3	straw bead (b)
193	16.2	straw bead (b)

Artifact #	Depth (cm)	Type
194	16.5	straw beads (b)
195	17.1	flake
196	19.0	straw bead (b)
197	16.9	straw bead (w) - under artifact 146
198	15.9	fiborous material - over rings
209	16.6	straw beads (w) - under artifact 188
210	17.5	flake - under rings
Rings		
200	16.4	ring
201	15.9	ring
202	16.0	ring
203	17.0	ring - seed within
204	15.6	ring
205	15.6	3 rings
206	15.5	3 rings - seed and beads within
207	15.5	ring
208	15.5	2 rings

(b) - blue (w) - white

the bead "strands" identified earlier. Again, they were found to be oriented in multiple, parallel sections suggesting several separate strands, or, more likely, an overlapped, single strand. As before, no color patterning was noted among the blue and white beads in the articulations. No intact stringing materials were found as well.

Below this bead assemblage were fragments of highly deteriorated leather. The leather, which was too fragmentary and deteriorated to be identified further, may have been the remnants of a pouch or garment. The leather was partially preserved by copper salts from fourteen brass rings that the leather pieces had covered. These rings were nested together, and were oriented in the same direction and connected to one another (Figure 39). The rings appeared to have been strung together, perhaps on a necklace. No stringing materials were found within the rings, but several tiny red glass bead fragments were found within the rings themselves. These beads (IIa55) though highly fragmentary, reinforce the assumption that the rings were strung on a necklace of some sort. Brass rings strung on glass-bead necklaces were reported as grave offerings at the Conoy Cemetery, 36LA40, which dates from 1718 to 1743 (Kent 1984:398). Karklins (1992:52,96) also notes similar usage of rings during the Contact Period in Eastern Canada.

Of the fourteen brass rings, twelve were "fede"-motif or "Claddagh" rings (Scarisbrick 1993). The rings bear the motif of two hands grasping a heart (Figure 33b). The motif is incorporated into the band and is not a separate bezel. Rings of this type were used as wedding rings amongst the people of Galway on the west coast of Ireland (Jones 1890). The motif designs on the rings recovered from the burial appear to have been hand engraved, not cast. Two plain, undecorated brass bands were found, each fused with four "Claddagh" rings of the ring assemblage. The final type of ring in the assemblage was a brass band that had been engraved with a diamond pattern on the entire

outside surface of the band. None of the rings bore any decorations or inscriptions inside of the bands.

The artifacts of Group 1 clearly are burial offerings placed in the pit at the time of interment. The clustering and articulation of the beads and rings suggests some form of stringing. These articles may also have been sewn onto a garment or placed in a pouch of some sort. The dense pack of stones associated with the artifacts of Group 1 also appears deliberate. Most of these stones were river cobbles and sandstone conglomerates. Few showed any signs of fire-cracking. The purpose of this stone assemblage of Group 1 is unknown.

Group 2 was another concentration of artifacts within the burial. This group was much smaller than Group 1, but like Group 1, it contained many river cobble and sandstone fragments. Only two glass trade beads were found in this group. Also, a number of lithic flakes and Clemson Island ceramic sherds were present. Although Group 2 resembled Group 1 in that they both contained a large amount of stones, the assemblage of Group 2 did not appear to be deliberately placed in the pit and most likely occurred during the digging of the pit and the burial of the body. Some scattered European goods were found in the general feature fill, although nearly all the European items found in the burial were located in and around Group 1. The most common artifacts in the fill, outside of Group 1, were lithic flakes, fire-cracked rock, and pre-Contact, Clemson Island ceramics. The presence of pre-Contact Period artifacts in the feature matrix can be explained by the fact that the feature was dug through older cultural horizons. When the fill was placed back into the grave, older prehistoric artifacts were included.

The burial treatment is difficult to ascertain, due to the absence of identifiable skeletal material. The presence of burial offerings suggest that this was a primary burial, although this cannot be said for certain. It is most likely that the skeleton deteriorated almost completely, leaving only one identifiable molar. It is also possible that the remains were disinterred at some point for reburial elsewhere, but this can only be postulated.

The date range of this burial, however, is more of a certainty due to the large numbers and types of glass trade beads found. It is estimated that the burial falls somewhere in the first half of the eighteenth century. This estimation was made due to the various wire wound and seed beads represented in the sample. Wire wound beads are characteristic of sites from this time period, such as the Park Site, 36LA96 (Kinsey and Custer 1982) and the Wapwallopen Site, 36LU43 (Kent 1984:213,405). Although the majority of beads found in this burial (blue and white tubular) were found at earlier sites such as the Strickler Site (36LA3), these bead types were also recovered from early to mid-eighteenth century sites such as Conestoga town (36LA52) and Conoy Cemetery (36LA40) (Kent 1984). The octagonal "Jesuit" ring also seems to confirm this date range.

TABLE 11
Summary Information on Contact Period Sites in the West Branch Valley of the Susquehanna - Lock Haven to Muncy

Map Number*	Site Name	Ethic Affiliation	Dates	References
10	Big Island	Delaware**	?-1763	Turnbaugh 1977:245
14	Canaserage	Shawnee	1755	Turnbaugh 1977:244, Wallace 1965:160
33	Dunnstown	?	1750's	Turnbaugh 1977:245, Kent 1984:90, Photographic Files, State Museum of Pennsylvania:B-1937
36	French Margaret's Town	Mixed	1745-1753	Turnbaugh 1977:245, Hunter 1956:5
42	Great Island	Shawnee, Delaware**	1741-1770	Turnbaugh 1977:245, Pennsylvania Archaeological Site Survey Files:36CN7
75	Nippenose Old Town	Delaware**	?	Wallace 1965:67, Donehoo 1928:129
84	Ostonwakin	Mixed (?)	?-1748	Turnbaugh 1977:244, Donehoo 1928:139
91	Pine Creek	?	?	Turnbaugh 1977:245
97	Quenischaschacki	Delaware**	?	Donehoo 1928:166,228, Wallace 1965:91
118	Tiquamingy Town	Delaware**	1759	Wallace 1965:91, Donehoo 1928:228, Scull 1770

Note: * -Source: Kent, Rice, Ota 1981: Map Attachment
** -The term "Delaware" is used here rather than the currently preferred "Lenape" because by the eighteenth century these groups could have been either true Unami-speaking Lenape of the Lower Delaware Valley and Delaware Bay Region, or related Munsee groups of the Upper Delaware Valley (Weslager 1972, Kraft 1986).

Non-Contact Features Containing Intrusive Contact Artifacts

Eight non-Contact (Clemson Island Period) features contained intrusive Contact artifacts. Two features in Section 1, (235 and 575) and six in Section 3 (11, 13, 42, 66, 104, and 129) are included in this category. Feature 235 contained one white tubular bead (Ia4; Kent 1984). Feature 575 contained three small pieces of unmodified olive bottle glass. One white seed bead (IIa11) was found in each of the following features: 13, 66, 104, and 129. One light blue seed bead (IIa?-13; Fogelman 1991) was found in Feature 42. Feature 11 contained one sherd of unmodified olive bottle glass.

Historical Context Research

A review of the available documentary information on the Contact Period in the West Branch Valley was undertaken in order to better understand the historical context of the finds of Contact Period artifacts in the project area, and to develop information that could be used to identify the potential ethnic affiliation of the Native American groups who might be associated with the Contact Period artifacts found at the West Water Street Site.

A recent compilation of information on eighteenth century Contact Period sites in Pennsylvania by Kent, Rice, and Ota (1981) provided a starting point for this review. Kent, Rice, and Ota (1981:Map Attachment) note two sites in the vicinity of Lock Haven and a total of ten sites in the West Branch Valley between Lock Haven and Muncy. Table 11 summarizes the information noted by Kent, Rice, and Ota (1981:8-11) for these sites. Much of the information in Table 11 is subject to question. In some cases, such as Ostonwakin, also known as Madame Montour's Village and Ostaugy (Turnbaugh 1977:244), the historic documentation is

derived from multiple sources (Bartram 1751; Zeisberger and Mack 1892) and there are finds of Contact period artifacts (Schoff 1937 in the case of Ostonwakin) to generally corroborate the historic documentation. However, most of the other examples in Table 11 are not as well documented historically or archaeologically. Nevertheless, the data in Table 11 provide the best current assessment of dates and ethnic groups occupying the sites.

The data in Table 11 indicate that most of the sites were occupied between 1725 and 1775. "Delaware" groups, who could be either Unami-speaking Lenape groups of the lower Delaware River Valley and Delaware Bay region or related Munsee groups of the upper parts of the Delaware Valley - north of the Forks of the Delaware at Easton - are the most commonly identified ethnic groups. The presence of Shawnee groups is also noted. It is most likely that the "mixed" groups also included Delaware and Shawnee groups.

With regard to ethnic groups, it is also important to note that some historical documentation for the presence of Iroquois groups in the West Branch Valley during the Contact Period is noted. For example, Meginness (1889:20-24) notes that several treaties and land sales recorded in the Pennsylvania Archives list various Seneca, Onondaga, and Oneida Iroquois leaders as signatories for lands in the West Branch Valley during the early eighteenth century. Jennings (1966, 1971) has noted that the Delaware and other groups were in a subservient role to the Iroquois after the establishment of the Covenant Chain and the Iroquois signatories for the West Branch valley may simply be reflecting this role. However, it is also possible that Iroquois groups were residing in the area at least during the first half of the eighteenth century. In sum, numerous different ethnic groups of Native Americans resided in the West Branch valley during the eighteenth century.

Two sites in Table 11 are located in the vicinity of Lock Haven: Great Island and Dunnstown. Both sites are located approximately 3 km downriver from the West Water Street Site. Great Island is located in the West Branch of the Susquehanna River near the mouth of Bald Eagle Creek. Turnbaugh (1977:245) notes that there have been numerous finds of eighteenth century historic artifacts on Great Island and many were most likely European trade goods deposited by Native American inhabitants of the island. Turnbaugh (1977:245) does not note the presence of any specific artifact types. However, the photographic records of artifact assemblages maintained by the State Museum of Pennsylvania depict glass beads, metal pendants, and catlinite calumet pipes from the Stewart Collection from the Great Island area. Meginness (1889:79-82) notes similar finds as does Johnston (1961), but some of these data are anecdotal and must be considered with some caution.

Historical documentation on the Contact Period occupation of Great Island is also mainly anecdotal (Meginness 1889:79-80;

Johnston 1961). Turnbaugh (1977:245) does note that Zeisberger and Mack (1892) reported the presence of three Native American houses on the island in 1748, and that these houses were occupied by Shawnees, Delawares, and "Maguas." The term "Magua" may be corruption of the term "Minqua" which was used to refer to the Susquehannocks who by the early seventeenth century had been dispersed from their main villages in the Lower Susquehanna Valley (Kent 1984:28-33). There is historic documentation to show that some of the Susquehannocks did move north to settle as refugees with the Seneca and other Iroquois groups (Jennings 1968).

Data on the Contact Period occupation of Dunnstown is even more fragmentary than that for Great Island. Turnbaugh (1977:245) again notes the presence of eighteenth century trade goods that were found in the area on the north side of the river downstream of Great Island. Similar artifacts are also depicted in the photographic records of The State Museum of Pennsylvania, but the provenience information is less than certain. Kent's (1984:90) comments on the site basically repeat those of Turnbaugh. In sum, it is likely that an eighteenth century Native American occupation was present in the vicinity of Dunnstown, but little more can be said concerning the identity of its inhabitants.

A final documented Contact Period site of the Lock Haven area is not mentioned by either Turnbaugh (1977) or Kent, Rice, and Ota (1981). T. B. Stewart (1939) describes the discovery of a Native American burial in 1851 when workmen were digging a cellar directly across the street from the Great Island Presbyterian Church on West Water Street. Based on Stewart's account, this site would be within 1000' of the current Phase III excavation areas. Stewart notes that a skeleton was found with a necklace of blue beads around its neck. He also notes that during the excavation of canal locks in Lock Haven, human remains accompanied by large amounts of white beads were found (Vento and Fitzgibbons 1989). Although these data are more than a little anecdotal and somewhat suspect they do suggest that Contact Period occupations may have been present along the shore of the Susquehanna River during the eighteenth century.

Analysis and Interpretation of the Contact Component

Previous testing of Section 3 of the West Water Street Site revealed the presence of Contact Period artifacts and indicated the possibility for intact features. Phase III testing confirmed the presence of Contact features, but only one was intact. Testing also revealed the absence of an intact living surface. Although many artifacts of European manufacture were recovered during test unit and feature excavation, the context in which the artifacts were found was disturbed, and hence, only artifacts that were unquestionable European-manufactured trade items or Contact Period native-manufactured items could be ascribed to the Contact Period. Therefore, artifacts such as gunflints or ball clay pipe fragments from this context, found commonly at

eighteenth century Contact sites and eighteenth and nineteenth century historic sites, cannot be used with complete certainty to describe and analyze the Contact Component.

The beads recovered during test unit excavations are extremely helpful in establishing a site date range. These beads, predominantly wire-wound types, date to the first half of the eighteenth century (Kent 1984:213). This date range is further strengthened by bead types recovered from features. Beads of similar types were reported at Conestoga Town (36LA52), Conoy Cemetery (36LA40), the Montgomery Site (36CL60), and the Wapwallopen Site (36LU43) (Kent 1984). Kinsey and Custer (1982) also reported wire-wound, faceted beads at the Park Site (36LA96). These sites all generally date to the middle part of the eighteenth century (ca. 1725-1775) and that is the suggested date range of the Contact Period component of the West Water Street Site.

The features of the Contact component are also revealing. The three probable and one possible refuse pit features indicate the presence of an occupation site, not just a burial site. The presence of carbon flecks, bone fragments, and fire-cracked rock in these pits suggest food preparation refuse. Unfortunately, the bone fragments could not be identified. Also, only uncharred seeds were recovered from the pits, and these cannot be used for the analysis of subsistence practices. No architectural features were found in association with the refuse pits. In fact, no Contact Period architectural features were identified at the entire site. Therefore, the research design topic concerning Contact Period house forms cannot be discussed.

Several native technologies are absent from the archaeological record of the Contact component of the West Water Street Site. No Contact Period native ceramic vessel or vessel sherds were recovered from test units or features at this site. The absence of these kinds of artifacts seems to confirm Kent's (1984) conclusion that native production of ceramic vessels had ended by 1690. Native vessels were replaced by vessels of European manufacture which included glass bottles and brass kettles, among others. Fragments of flaked olive bottle glass were recovered from West Water Street indicating that Contact Period Native American inhabitants of the site did possess European bottles and some form of flaking technology was still in use at the time. The flaked pieces of olive bottle glass were in the forms of unifacial scrapers and scraping tools. A large sample of cryptocrystalline and other lithic debitage and tools were recovered from Contact features and test units, but, again, the contexts were disturbed and these artifacts may be from an earlier prehistoric occupation. It is safe to assume, however, that some of these materials did originate from Contact Period lithic tool manufacture.

Other native technologies are represented by the two trapezoidal catlinite beads and the clay effigy pipe fragment found at the site. Catlinite artifacts are rare in the Eastern

Woodlands east of the Ohio Valley and represent part of a far-flung trade network (Kinsey and Custer 1982). The source of the material is probably Minnesota (Kent 1984:166). The place and date of the manufacture of these beads is unknown. Similar beads were found in burials at Conestoga Town, the Conoy Cemetery, the Wapwallopen Site (Kent 1984:169), and the Park Site (Kinsey and Custer 1982). Kent also notes the presence of catlinite objects at earlier sites in the Susquehanna Valley (1984:167). The clay effigy pipe is another example of a native-produced item. But, as with the catlinite beads, age and tribal affiliations are impossible to determine.

A good example of Native American ceremonialism is the deliberate placement of grave goods in the burial (Feature 531). The offering of grave goods was common among Contact Period Indians of Pennsylvania. Kent (1984:390) illustrates the meaning of the burial offerings in a reprint of a letter written by Bishop Cammerhof to Count Zinzendorf that recounts the Bishop's observation of a native funeral at Shamokin in 1748:

> Our brethren attend the funeral of the [Indian] child. Its mother showed them the child in the coffin with its presents viz: a blanket, several pairs of moccasins, buckskins for new ones, needle and thread, a kettle, two hatchets-one large and one smaller-to cut kindling wood, flint, steel and tinder, so that on its arrival in the "new country," it could at once go to housekeeping. Besides, it was beautifully painted and had a supply of beans, corn, and calabash. The Indians thought it was cruel in us not to have supplied Hagen [a white man who died at Shamokin the year before] with all these things... After the funeral she [the Mother] came to our house with a quart tin which she gave to Sr. Mack, saying: "This had been my daughter's-keep it in remembrance of her." It is an Indian custom, that when one dies, not all the effects are buried with it, but some are reserved for distribution among the deceased ones friends (Wallace 1945:272-73).

Conclusions

The late Contact Period (late seventeenth through the eighteenth century) in Pennsylvania is characterized by a great upheaval of Native American culture. During this period, native peoples were becoming more acculturated, abandoning traditional technologies and lifeways. European goods were relied upon for all aspects of life. Native peoples had been displaced and tribal affiliations were disrupted. A general trend of migration of Pennsylvania's Indians was to the north and west and away from traditional lands purchased by European colonists.

Documentary and archaeological evidence indicates that numerous Native American groups, including the Shawnee, Delaware,

and Iroquois, were present in the Lock Haven section of the West Branch Valley in the eighteenth century. The Contact component in the study area is related to one or more of these groups; however, neither the artifacts of native origin nor of European manufacture are distinctive enough to reveal tribal affiliations. The mix of native and European goods does indicate a high degree of acculturation for the Contact Period inhabitants of the West Water Street Site. The fact that most grave goods are items of adornment, rather than utilitarian items, also attests to the relative poverty of eighteenth century Contact Period material culture.

The rather sporadic occurrence of eighteenth century Contact Period artifacts throughout the West Water Street Site, and the individual burial, suggest a scattered and dispersed settlement pattern of small social groups with the nuclear family being the major social unit. In fact, the available historic documentation and the reports of earlier finds of Contact Period artifacts suggest a similar pattern for the entire Lock Haven area from the West Water Street Site to Dunnstown. A dispersed settlement pattern is consistent with data from Conestoga Town in Lancaster County (Kent 1984:379-391), which dates to the same time period. In fact, Kent, Rice, and Ota (1981:4-5) suggest that: "Many of the towns of this period can be more accurately described as large regions throughout which small farm communities were scattered." The Contact Period component of the West Water Street Site fits this model of settlement pattern rather well.

It is most important to note, however, that some eighteenth century Contact towns may have been larger. For example, Conoy Town in Lancaster County, could have been occupied by as many as 130 people (Kent 1984:401) and seems to have supported a much more densely populated village. However, Conoy Town was occupied by southern Algonkian Piscataway groups of the Potomac Valley who had more complex social organizations than local Delaware, Shawnee, and Iroquoian groups (Potter 1993). In conclusion, the Contact Period occupation of the West Water Street Site is consistent with other sites where the main occupations seem to be scattered hamlets. Nevertheless, considerable variability existed among Contact Period occupations due to varied ethnic origins and varied levels of acculturation.

CLEMSON ISLAND COMPONENT EXCAVATION RESULTS

Introduction

As was noted earlier in the discussion of the contextual integrity of the West Water Street Site, artifacts dating to the Clemson Island occupation of the site are mixed with artifacts from much earlier time periods in all areas of the site. The mixing of artifacts occurs in the upper surface soils dating to the time period of the Clemson Island occupation as well as in the pit features that were dug, and later filled, by Clemson Island groups. Furthermore, many of the Clemson Island features

cross-cut one another in patterns that do not even allow the determination of their relative chronology (e.g. - Figure 23). It is very difficult, if not impossible, therefore, to determine if associations among Clemson Island artifacts and ecofacts in pit features represent time frames of years or millennia.

In spite of these problems with the contextual integrity of the Clemson Island component, some research issues can still be addressed through the analysis of the artifacts and features. The research design for the Clemson Island component, described earlier in this report, noted that the major concern of the West Water Street Site excavations of the Clemson Island component was to gather data that could be used to study changing community patterns through time. Specifically, the excavation of the Clemson Island occupations at the West Water Street Site sought to identify the different Clemson Island community types that might be present at the site.

Based on recent reviews of Clemson Island cultures (Stewart 1990; Hay, Hatch, and Sutton 1987) and recently reported excavations of the Airport II Site - a Clemson Island site in the Wyoming Valley (Garrahan 1990) - three basic Clemson Island habitation site types, as opposed to special purpose camps, appear to be present in the archaeological record: 1) individual farmsteads/household clusters (Figure 6, Stage 1), 2) hamlets (Figure 6, Stage 2), and 3) fortified hamlets/agglutinated villages (Figure 6, Stage 3). Examples of Clemson Island individual farmsteads/household clusters and hamlets are well known and clearly defined (Table 3) and appear to be the most common community type for the Clemson Island culture. However, the larger Clemson Island sites are not as well known or as clearly defined. The recently excavated Airport II Site (Garrahan 1990) provides a good example of a fortified hamlet with its three clearly identified houses within its stockade, or fence, and room for possibly two more for a total of five. The only other larger potential Clemson Island sites are the Fisher Farm and Ramm Sites (Stewart 1990:93), but the recognition of the contemporaneity of the multiple houses at these sites is problematic due to some of the same factors that complicate the interpretation of the Clemson Island components at the West Water Street Site. In general, a major current research question in Clemson Island community studies is, "Just how big were the largest Clemson Island communities?" The current data would suggest that the largest clearly defined individual community is the fortified hamlet at the Airport II site.

With regard to the research question noted above, excavations of the Clemson Island occupation at the West Water Street Site opened the largest possible area within the levee construction zone in order to allow for the exposure of the largest number of features possible. It was originally hoped that we would find a large number of features and then be able to determine if the features related to numerous occupations by small groups, or a single contemporaneous occupation by multiple social groups. Many Clemson Island features were found; however,

the discovery of the compromised contexts of the Clemson Island features made it nearly impossible to address the issue of feature contemporaneity. Nonetheless, we were fortunate to encounter post mold patterns in one area of the site (Figure 26) that revealed an arrangement of features that seem to indicate the presence of a small fortified hamlet like that of the Airport II Site.

It is important to note that the arrangement of features is the main source of data on potential contemporaneity of the features at the West Water Street Site and the identification of the potential community types. At some Clemson Island sites, such as the Saint Anthony Site (Stewart 1988), the context of features and living surfaces deposits is not compromised and the association of chronologically sensitive ceramic types and radiocarbon dates can be used to isolate sets of features that seem to be contemporaneous and thereby define community patterns. Indeed, a research program where the identification of undisturbed stratigraphic contexts is used to define and evaluate archaeological cultural assemblages is the preferred alternative research program (see discussion in Evans and Custer 1990). Unfortunately, such a research program is not possible for the Clemson Island components of the West Water Street Site due to the mixed contexts. Instead, we will describe the arrangement of features, identify what seem to be community patterns, and then look at the artifacts from these features, especially those that show minimal signs of disturbance, to try to evaluate the alleged community patterns. At best, the data from the feature contents can be used to test and enhance the notion that the observed arrangements of features do indeed illustrate community patterns.

With regard to the general Clemson Island research question concerning community patterning at the West Water Street Site, it is also important to consider the spatial sample generated by the excavations. Excavations of the Clemson Island component were confined to the "footprint" of the proposed levee and, consequently, were in the shape of a narrow strip, or transect, approximately 30 m wide, paralleling the bank of the Susquehanna River for a distance of more than 250 m. This transect had the potential to "slice" through portions of a variety of communities distributed along the river shore, as indeed it did. However, the narrow transect did not always provide sufficient exposure of sets of features to allow the determination of community patterns. In the case of the potential small fortified hamlet noted above (Figure 26), we were fortunate that it was located directly in the path of the transect. However, through the remaining 80% of the transect we are clearly only seeing parts of communities. It is also clear that erosion and historic land disturbance had cut into the river bank, truncated the natural levee, and destroyed portions of the archaeological remains of the varied Clemson Island communities that were located on the river side of the natural levee.

In sum, in most cases we are only able to look at a fragment of a Clemson Island community's feature arrangement at the West

Water Street Site. The archaeological record of the Clemson Island occupations of the West Water Street Site had already been compromised by natural and earlier cultural disturbances. Furthermore, the transect of excavations only sampled a portion of the communities and feature arrangements. Nonetheless, significant data on Clemson Island community patterns were gathered and are described below. The types of features in each section of Clemson Island excavations (Figures 23-27) and their arrangements are described first. Then, chronological data relevant to the feature arrangements are noted. Finally, topics related to general lithic technology, ceramic technology, human remains, and floral and faunal remains are discussed.

Feature Types and Distributions

Before considering the distribution and potential community arrangements of features, it is necessary to describe the various types of features encountered in the Clemson Island component of the West Water Street Site.

Feature Typology. In order to organize the study of the pit features at the West Water Street Site, a series of feature types were defined based on the size and shape of the pits. The contents of the features were considered as part of the typology only to a limited degree because feature contents did not vary greatly among the different shapes and sizes of feature, with a few exceptions that are noted below, and because of the problems with feature context noted previously.

Shape attributes of the features used in the typology included horizontal plan view (circular, oval, amorphous), vertical profile of feature walls (gradually sloping, steeply sloping, straight), and feature floor contour (round, flat, conical). Feature size, especially feature depth, was more difficult to address in the typology because many of the features were truncated by various episodes of historic filling and grading. Feature size was generally addressed by defining the basic categories on the basis of shape and noting the size variability observed among similarly shaped features.

Figure 40 shows the nine basic feature types identified in the Clemson Island component at the West Water Street Site. Three additional feature sub-types which are variations on some of the major types are also noted. Table 12 lists the size ranges of each feature type and Table 13 lists the frequencies of each feature type in the excavation areas depicted in Figures 23-27. Each feature type is discussed below.

Type I features are small circular pits with sloping walls and a rounded bottom (Figure 41). In two cases the bottoms of the features are flat. This particular feature type is one of the few types where feature fill played a role in the definition of the type. All Type I features are completely filled with densely packed charred corn cobs without kernels. The density of the cobs within the pit fill suggests that they were

FIGURE 40

Clemson Island Feature Types

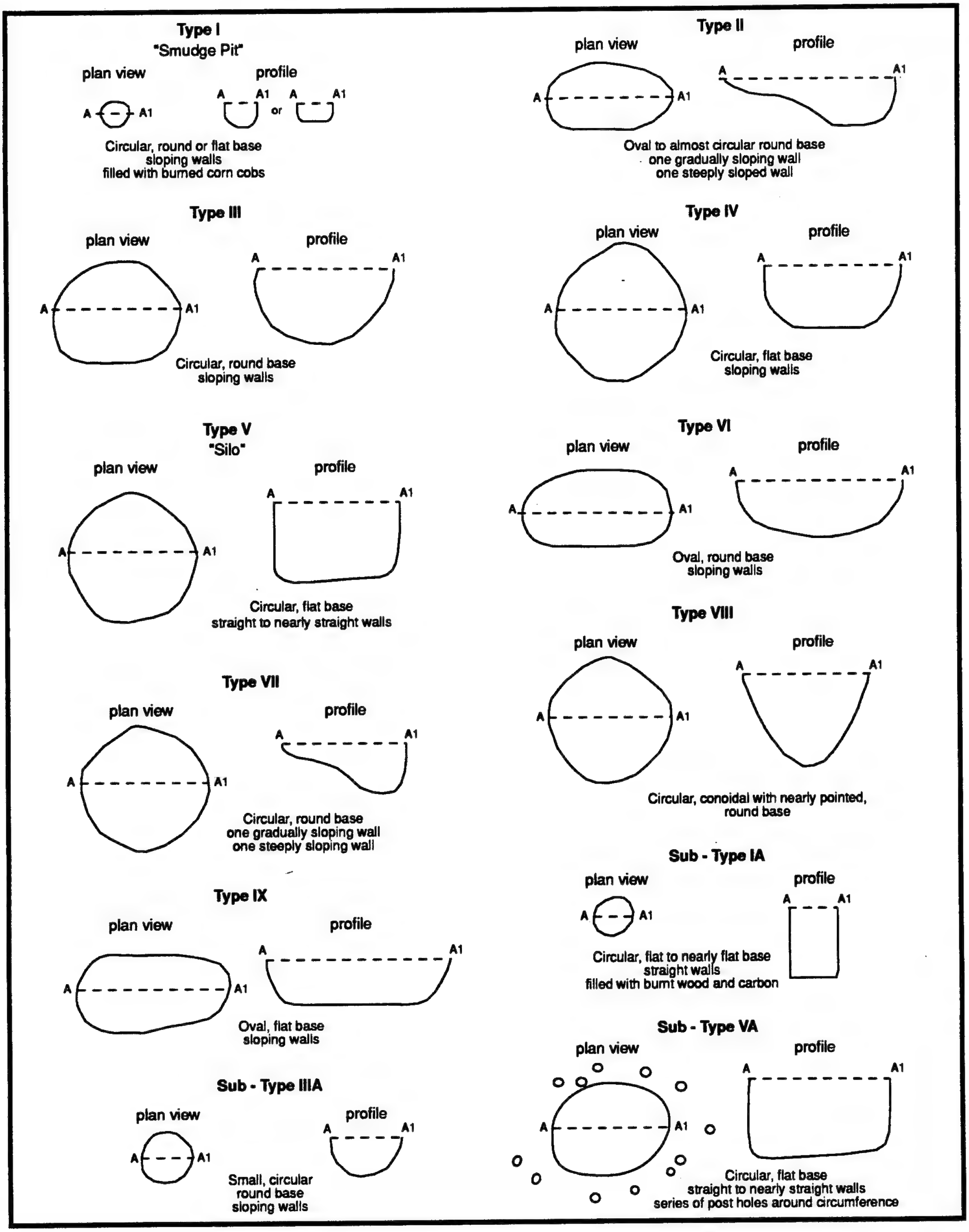


TABLE 12
Clemson Island Feature Type Size Ranges

Feature Type	Diameter	Length/ Width	Depth	Number
I	20-70 centimeters	not available	4-36 centimeters	27
IA	20-38 centimeters	not available	4-21 centimeters	8
II	not available	55-250 centimeters/ 35-160 centimeters	10-50 centimeters	34
III	60-175 centimeters	not available	10-75 centimeters	43
IIIA	20-50 centimeters	not available	6-23 centimeters	8
IV	75-215 centimeters	not available	12-65 centimeters	25
V	58-220 centimeters	not available	20-100 centimeters	12
VA	(same as V)			2
VI	not available	80-200 centimeters/ 56-125 centimeters	10-40 centimeters	54
VII	80-110 centimeters	not available	10-25 centimeters	10
VIII	65-170 centimeters	not available	32-50 centimeters	7
IX	not available	30-175 centimeters/ 20-130 centimeters	8-65 centimeters	18

TABLE 13
Feature Type Counts by Areas

	Areas					
Feature Type	Section I East	Section 1 Middle	Section 1 West	Section 3 East	Section 3 West	Total
I	0	0	3	15	9	27
IA	0	0	0	6	2	8
II	13	3	6	8	4	34
III/IIIA	5	8	4	20	6	43
IV	3	8	2	7	5	25
V	10	0	0	1	1	12
VA	1	1	0	0	0	2
VI	3	6	7	34	4	54
VII	2	3	0	3	2	10
VIII	1	4	0	0	2	7
IX	0	7	0	6	5	18
Unidentified	7	11	3	5	2	28
Total	45	51	25	105	42	268

FIGURE 41
Typical Type I Feature

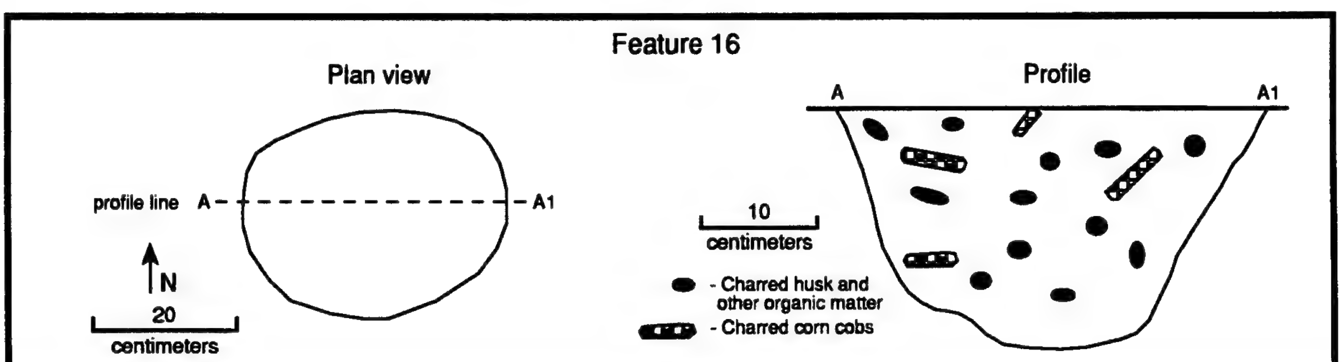


FIGURE 42

Typical Type II Feature

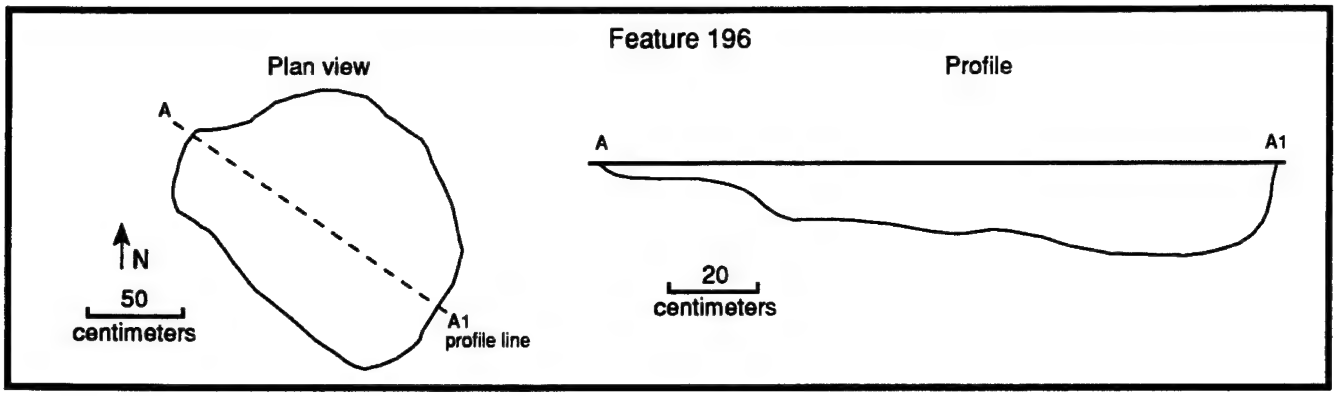


FIGURE 43

Plan View of Feature 55

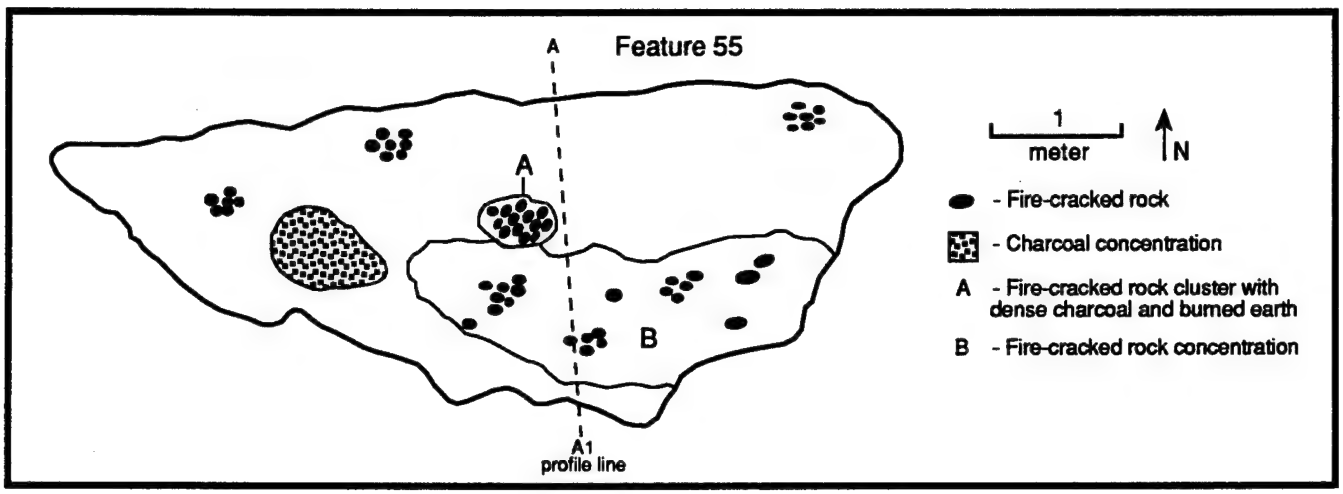
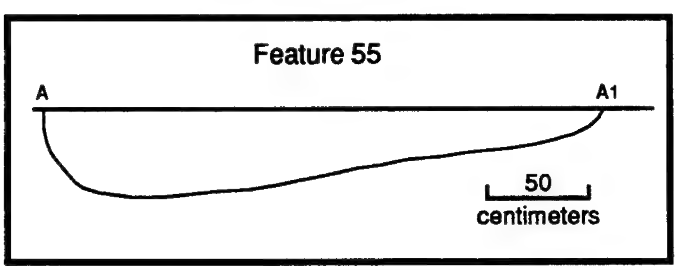


FIGURE 44

Profile of Feature 55



intentionally filled with the corn cobs. Feature Type IA is a variant of this type, but contains charred materials other than corn.

Type I features differ from all other features at the site in that their context does not appear to be compromised like that of other features. Most other larger features at the site probably were not intentionally filled, and accumulated artifacts and soils from a variety of processes at different points in time after they were abandoned (see Moeller 1993 for a discussion of the processes of pit filling episodes at Late Woodland sites). In contrast, Type I pits seem to have been purposely filled and their contents probably do indeed reflect limited points in time and meaningful cultural activities.

Type I features exhibit all of the attributes of "smudge pit features" as described by Binford (1967) including: small size, contents consisting of charred corncobs without kernels, and a primary depositional context. Using a variety of ethnographic examples from the Southeast, the Plains, and the Great Lakes, Binford suggests that these features were used to produce smoky fires. The smoke from these features were then used in the process of tanning hides. Based on the striking similarity of Type I features from the West Water Street Site with ethnographic examples, Type I features are considered here to be "smudge pits."

Type II features are oval in plan view and generally have round bases (Figure 42). The wall on one side of the feature gradually slopes to the base of the feature while the other wall slopes more steeply giving the feature a shallow half and a deep half. Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

One Type II feature (Feature 55) was exceptionally large with a length of 6.3 m and a width of 2.6 m. Figure 43 shows a plan view of this feature and Figure 44 shows its cross-section. A large quantity of fire-cracked rock was present in this feature and many of the pieces fit together. Feature 55 is either a large platform hearth, shallow roasting pit, or stone boiling feature. The fire-cracked rocks are similar to those described by Cavallo (1987) in stone boiling features identified at the Abbott Farm Site in the Delaware River Valley Fall Line Zone. Similar features were also identified at the Snapp Site (Custer and Silber n.d.) in the northern Delaware Peninsula, and at numerous sites in the Upper Delaware Valley (Kinsey 1972; Kraft 1975). These large rock-filled features are usually found in riverine settings, like that of the West Water Street Site, and are thought to be related to the processing of fish resources either through drying, smoking, roasting, or rendering of their oils in ceramic vessels. Ozker (1982) also suggests that rendering of oils from nuts may have also taken place around these features. Numerous Clemson Island pottery sherds were found in this feature and may have been related to an oil

FIGURE 45

Typical Type III Feature

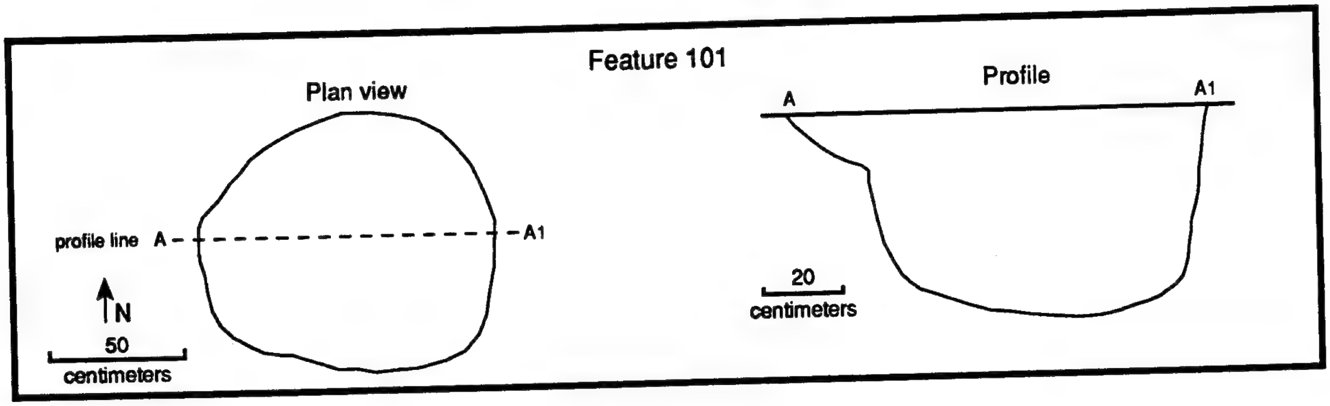


FIGURE 46

Typical Type IV Feature

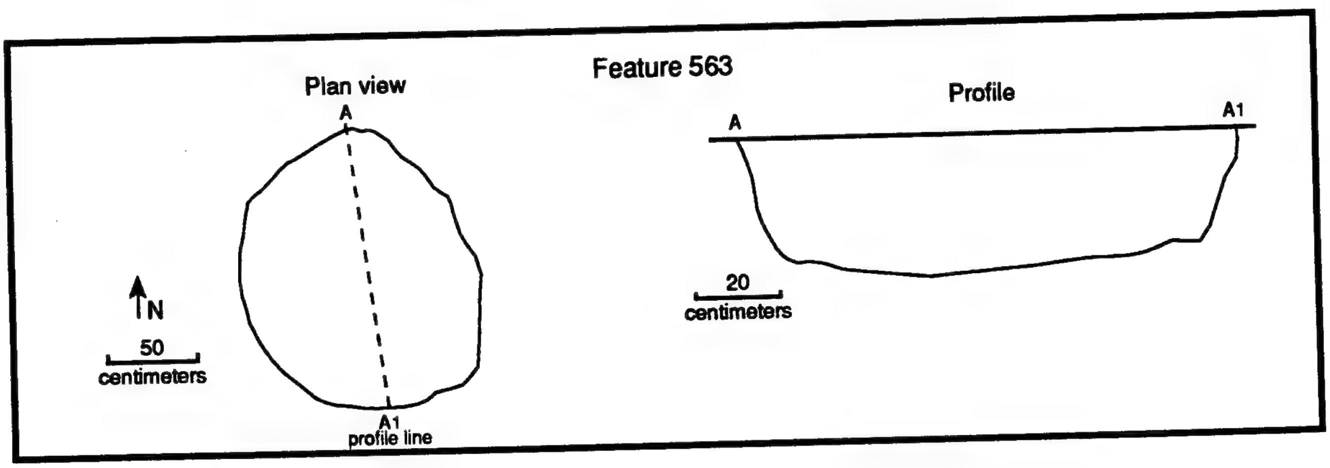
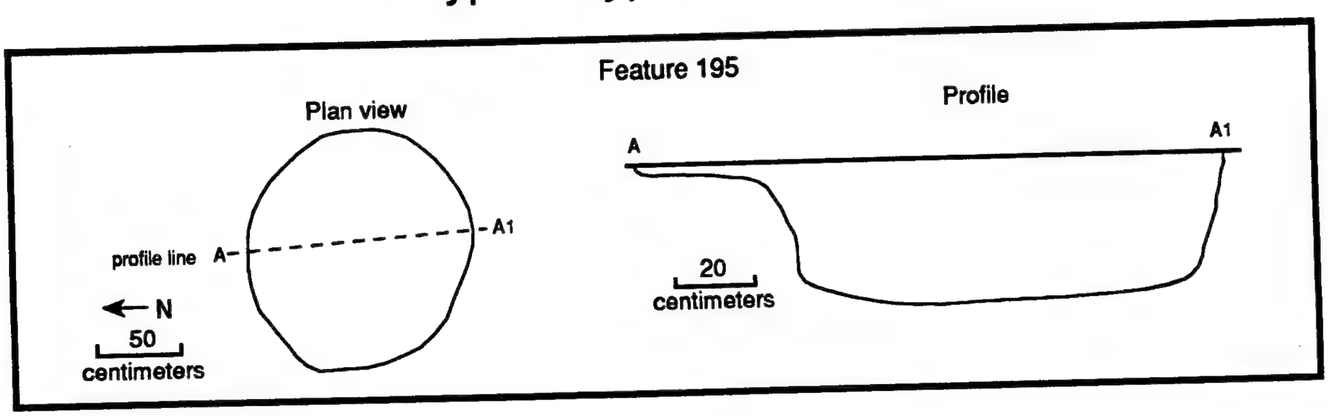


FIGURE 47

Typical Type V Feature



rendering activity. Although Feature 55 was partially disturbed by historic cut and fill activities, it almost certainly dates to the Late Woodland Clemson Island component. The examples of similar features at other sites noted above all date to pre-Late Woodland times. Therefore, Feature 55 is one of the first examples of such a large feature from Late Woodland times.

Type III features are circular in plan view and have round bases and sloping walls (Figure 45). Examples of a smaller subtype of these feature (Type IIIA) are also present. Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

Feature Type IV is circular in plan view with sloping walls and a flat base (Figure 46). Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

Type V features are circular in plan view and have straight walls with flat bottoms (Figure 47). Many of these features were rather deep and they are similar to "silo" features identified at Late Woodland sites in the Upper Delaware Valley (Kraft 1975:67). They most likely served as storage features for plant food and other items and later accumulated refuse and debris after they were no longer used for storage. Type VA includes two examples which are identical to Type V features except that these two examples were surrounded by a series of small post molds (Figure 48). Similar post mold configurations were observed in the Upper Delaware Valley (Kraft 1975:82) and are thought to be part of some specialized covering for the structures. Ojibway groups of the Great Lakes region construct small structures above in-ground storage pits for wild rice and these structures generally consist of a interwoven wicker-work circular structure with a domed roof (Vennum 1988:147). Type VA structures probably represent similar storage facilities.

A typical Type VI feature is illustrated in Figure 49. These features are oval in plan view and have round bases and sloping walls. Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

Type VII features are very similar to Type II features except that they have oval plan views (Figure 50). Their sides are gently sloping on one side and more steeply sloping on the other. Some of these features contained variable quantities of fire cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

FIGURE 48

Typical Type VA Feature

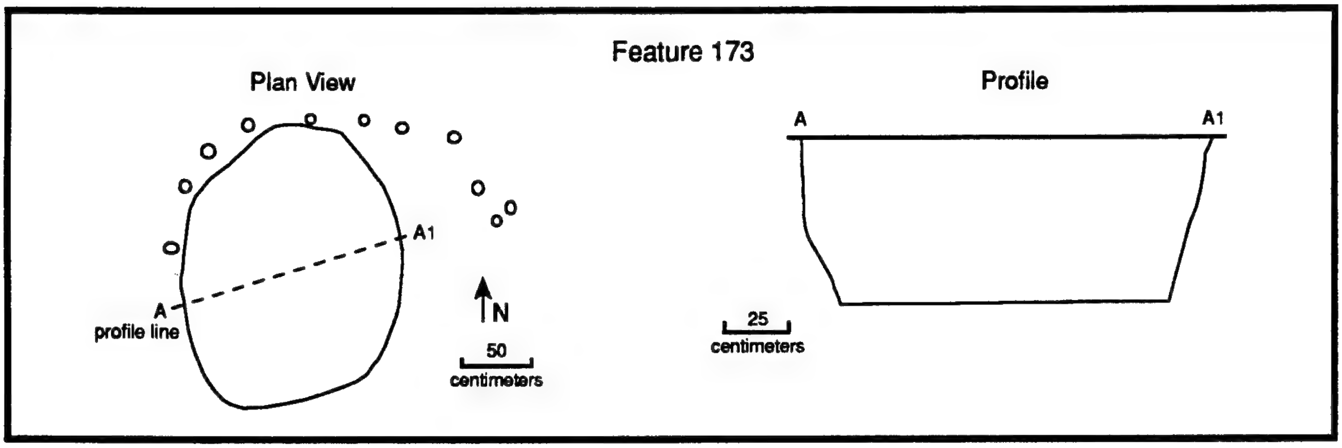


FIGURE 49

Typical Type VI Feature

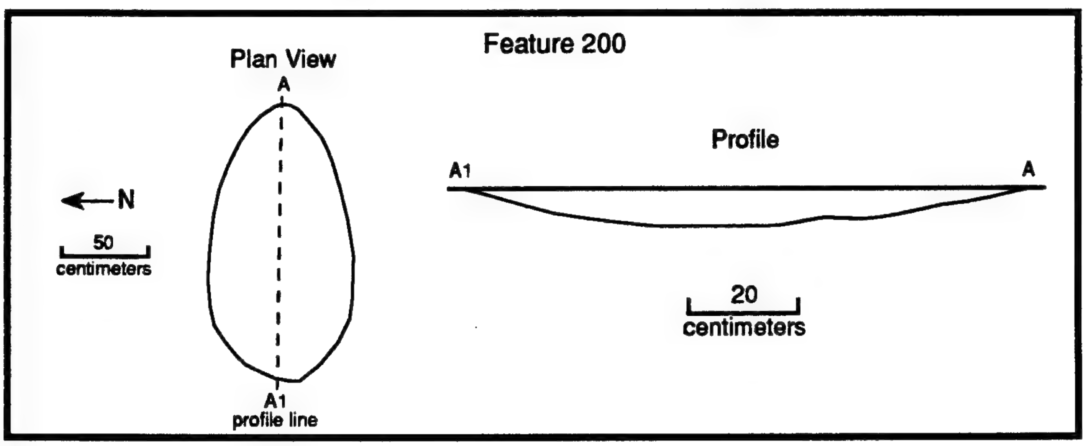


FIGURE 50

Typical Type VII Feature

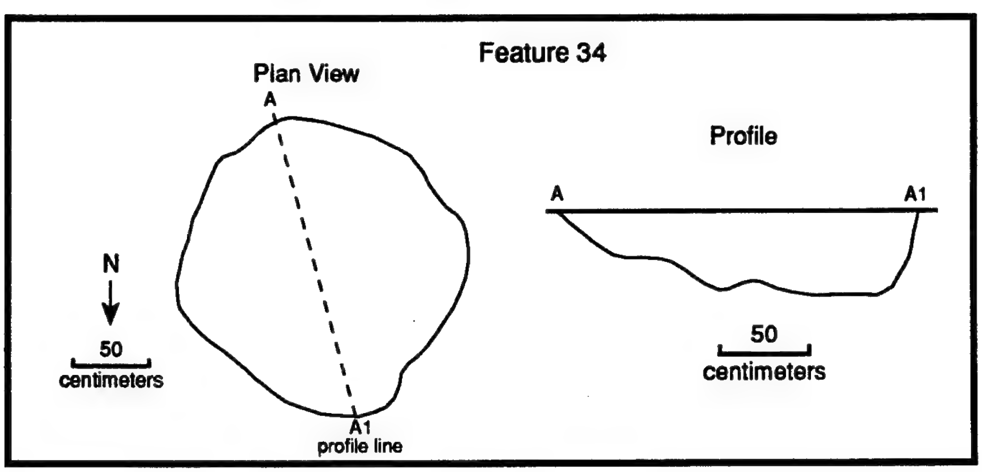


FIGURE 51

Typical Type VIII Feature

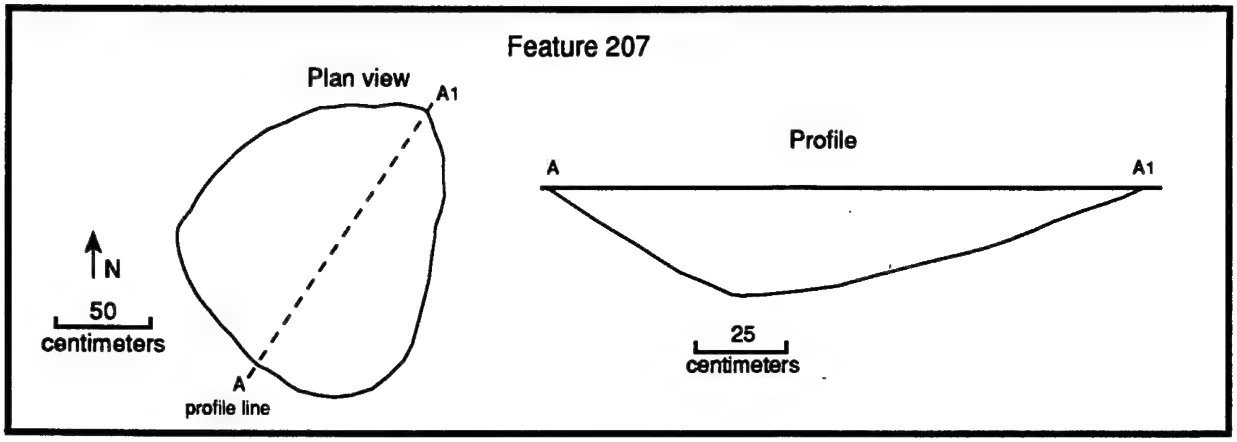
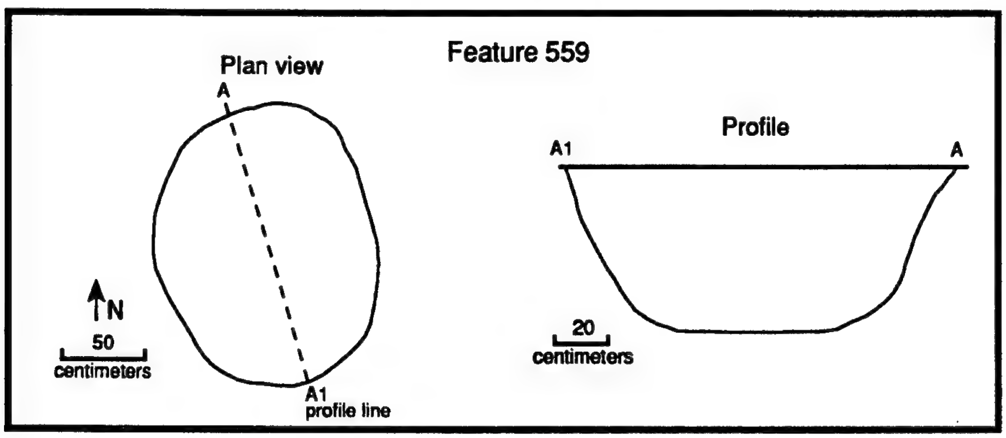


FIGURE 52

Typical Type IX Feature



Type VIII features are not common at the site and have circular plan views (Figure 51). Their profile is conoidal in shape and they have round, pointed bases. Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

The final feature type (Type IX) is an oval version of Type IV with sloping walls and a flat bottom (Figure 52). Feature 559, a burial feature, falls within this feature category. Some of these features contained variable quantities of fire-cracked rock and may have functioned as hearths or earth ovens; however, many contained no fire-cracked rock at all.

In sum, several of the feature types noted above have functional significance. Type I features are probably "smudge

TABLE 14
Clemson Island Feature Percentages by Type

Feature Type	Section 1 East	Section 1 Middle	Section 1 West	Section 3 East	Section 3 West
		Areas			
I/IA	0	0	8	60	32
II	38	9	18	23	12
III/IIIA	12	19	9	47	13
IV	12	32	8	28	20
V/VA	71	7	0	7	7
VI	5	11	12	63	7
VII	20	30	0	30	20
VIII	14	57	0	0	29
IX	0	39	0	33	28
Total percent of all Features	16	19	9	39	16

pits" associated with hide processing. Type II features may be hearths or earth ovens. Type V features are especially large in-ground storage features, or "silos" and some examples may have had above-ground components. Types III, IV, VI, VII, VIII, IX all are either storage or processing features that were later filled with refuse. No more precise determinations of feature functions are possible given the problems of the context of the Clemson Island component noted above.

Feature Distribution. The distribution of the feature types noted above in each of the mapped site sub-areas (Figures 23-27) will be described below. Spatial distributions will be noted, but first, the general comparative distribution of feature types among the areas will be noted.

Table 14 shows the percentage distribution of each feature type within the five areas. The percentage values are based on totals from the rows of Table 13. Examination of the last row of Table 14 shows that most of the total features were found in Section 3 - East Half. Section 1 - Eastern Portion, Section 1 - Middle Portion, and Section 3 - Western Portion all have equal proportions of the total feature assemblage. Section 1 - West contains the smallest proportion of the feature assemblage. It is interesting to compare the individual feature type percentages in the table's body with the total percentage values at the bottom of the table. If the feature type percentages differ from the total percentage, then the individual feature types are showing significant clustering, or absence, in the particular site area.

Feature Types I and IA are clearly clustered in the eastern and western portions of Section 3 (Figures 26 and 27) with the densest clustering in the eastern portion. These feature types are probably associated with hide processing and their clustering in these areas may indicate the presence of functionally specific resource processing areas in these portions of the site. It is also interesting to observe that the eastern portion of Section 3 (Figure 26) is the location a series of potential house patterns

TABLE 15
Clemson Island Feature Percentages by Area

Feature Type	Section 1 East	Section 1 Middle	Section 1 West	Section 3 East	Section 3 West	Total % of all Features
	Areas					
I/IA	0	0	12	20	26	13
II	29	6	24	7	9	13
III/IIIA	11	16	16	19	14	16
IV	6	15	8	6	12	9
V/VA	24	2	0	1	2	5
VI	6	12	28	32	10	20
VII	4	6	0	3	5	4
VIII	2	8	0	0	5	3
IX	0	14	0	6	12	7

and a stockaded community pattern. Further discussion of this site area and its related features will be provided later in this report.

Type II features, which have no special associated functions, are somewhat clustered in the eastern portion of Section 1 along with Type V and VA features, which are densely clustered in that area (Figure 23). Type V features were identified as large, specialized, high volume storage facilities and their clustering with Type II features would indicate that the eastern portion of Section 1 is a specialized storage area that was the part of a larger community.

No special clustering in sub-areas of the site is noted for Types III/IIIA, IV, and VII. Type VI features do seem to be clustered in Section 3 - East, but the lack of a functional attribution for the feature type makes this clustering impossible to interpret. The same point can be noted for the clustering of Type VIII and Type IX features in Section 1 - Middle.

Table 15 shows the percentage values of feature types by areas based on the totals for the columns of Table B. Examination of the last column of Table 15 shows that the most common feature type is Type VI. Types I/IA, II, and III share moderate proportions of the feature assemblage and Types IV, V/VA, VII, VIII, and IX share a lower proportion of the assemblage. As was done for Table 14, it is interesting to compare the individual feature type percentages in the body of Table 15 with the total percentage values in the right hand column of the table. Variations in the percentage values confirm the same patterning of clustering of feature types in site areas as shown in Table 14 and noted above.

The patterned quantitative distribution of features within each of the site areas can be used to guide a review of each area's spatial distribution of features. As was noted above, the eastern portion of Section 1 (Figure 23) shows an especially dense clustering of high volume storage features. The features are densely packed and many cross-cut one another. No signs of posts associated with house patterns are present, and this section of the site seems to be exclusively associated with

storage activities of Clemson Island groups who lived in adjacent unexcavated areas outside the project area. The disturbed context of many of the features, which is due to the cross-cutting nature of the features themselves, makes it difficult to assess the time span represented by these features. However, some possible interpretations can be made.

The dense clustering of high volume storage features, the absence of other types of features, and the cross-cutting and overlapping distribution of the features indicate that this area was repeatedly reused solely for storage activities. The post mold pattern around the circumference of Feature 173, and traces of a similar pattern around Feature 201, also indicate that these storage facilities could also be rather elaborate. Two scenarios could explain the creation of such a dense storage area. It is possible that this dense concentration of storage features could have been created by numerous small hamlet occupations in this area of the site outside of the excavation area. The cross-cutting nature of the features does suggest serial reuse of the site over time. However, nearly exclusive use of the area for storage over multiple occupations suggests a pattern of repeated spatial utilization that is hard to imagine resulting from occasional reuse of this section of the levee by unrelated groups over centuries, or even decades.

It is easier to imagine that if this feature cluster was created by small groups, they inhabited this section of the site over a relatively short period of time, perhaps less than a decade. The time interval between the uses of the area had to be small enough so that the different groups generally knew where the earlier storage had taken place and could use the same area for the same purposes. However, enough of a time interval passed for groups not to know exact feature locations as evidenced by the fact that later features were excavated into earlier features, as occurred in the complex of overlapping features designated as Feature 194A-D. Similar patterns of function-specific spatial use have been observed at the Island Field Cemetery (Custer, Rosenberg, Mellin, and Washburn 1990) and the interpretations of intervals of site use for these types of patterns of spatial use have been developed by Higham (1989) during the study of cemetery sites in Thailand.

In sum, if the clustering of storage features in the eastern end of Section 1 was produced by a number of small occupations over time, the time interval between occupations was not long and occurred with enough regularity that specific areas were used for specific purposes over the course of more than one year. This specificity of spatial use also would seem to imply that the same group, or related groups, returned to the same place on the levee year after year. Such repeated use may indicate that a well-developed sense of territory on a small spatial scale was present during Clemson Island times, as has been suggested by Stewart (1990:97-99) based on regional settlement data. It is also possible that this pattern of spatial use indicates a relatively

TABLE 16
Comparative Village Dimensions - Longest Axis

Site Name	Cultural Affiliation	Size (meters)	Size (feet)	References
Murry	Shenks Ferry	135	450	Kinsey and Graybill 1971
Slackwater	Shenks Ferry	80	263	Custer, Hoseth, Chesaek, Guttman, and Iplenski 1993
Strickler	Susquehannock	226	742	Kent 1984:350
Oscar Leibhart	Susquehannock	215	710	Kent 1984:369
Byrd Leibhart	Susquehannock	204	670	Kent 1984:373
Bull Run	Shenks Ferry	60	200	Bressler 1980:37
Quiggle	Proto-Susquehannock	55	180	Smith 1984:33
Funk	Shenks Ferry	120	396	Smith and Graybill 1977:50
Schacht	Wyoming Valley	74	243	Smith 1973:46
Bates	Owasco	29	95	Ritchie and Funk 1973:227
Kelso	Owasco	88	290	Ritchie and Funk 1973:255
Getman	Proto-Mohawk	96	315	Ritchie and Funk 1973:298
Garoga	Mohawk	152	500	Ritchie and Funk 1973:314
Airport II	Clemson Island	30	100	Garrahan 1990:5

permanent occupation of certain sections of the levee at the Water Street West Site. In any event, even though this feature distribution could have been produced by numerous small groups, the occupation and use of the site was probably more intensive than the sporadic hamlet occupations often portrayed by many Clemson Island settlement pattern studies.

A second scenario that could explain the feature distribution in this section of the site is that it represents a very short time interval and is a specialized storage area associated with a much larger Clemson Island community. Such specialized storage areas are not commonly identified at villages in eastern and central Pennsylvania (see Figures 6 and 7 for the most common village patterns); however, they have been noted at Monongahela sites (Hart 1993a), Fort Ancient sites (Graybill 1981), and some smaller Mississippian sites (Gardner 1969; Smith 1985).

In considering the possibility that the clustered storage features in the eastern end of Section 1 are part of larger community, it is interesting to note that a section of a palisade and two houses dating to the Clemson Island occupation are present in the eastern half of Section 3 (Figure 26). A more detailed description of the houses and stockade is provided later in this report; however, it can be noted that the partial stockade extends east from Section 3 in the direction of Section 1. One could speculate that the storage area in Section 1 is part of the same community with the stockade in Section 3. If both excavation areas do indeed comprise a single large Clemson Island occupation, this occupation would extend for more than 500′ (165 m) along the levee.

Table 16 lists a series of comparative village dimensions for numerous Late Woodland sites. The only other Clemson Island site where a stockade defines a community that can be measured is the Airport II Site, which is less than 20% of the size of the hypothesized Clemson Island community noted above. The hypothesized West Water Street Site community would also be

bigger than comparably dated Owasco sites from New York and most Late Woodland village sites of the Susquehanna Valley, including Shenks Ferry sites which would follow Clemson Island sites in the local cultural sequence. A village that spanned more than 500′ would be more comparable in size to Contact Period village sites of the Susquehannocks and the Mohawk. Based on the comparative data in Table 16, and the scant data available on community patterning from the West Water Street Site, the existence of a 500′ (165 m) -long Clemson Island village is not very likely. However, given the small sample of sites where we can estimate Late Woodland village sizes, and given our increased appreciation for variability in the archaeological record, it is possible that a very large Clemson Island village was present at the West Water Street Site.

Figure 24 shows the distribution of features in the middle portion of Section 1 and the feature density is not as great as in other areas. A variety of feature types are present including a Type VA feature (Feature 557) and a burial (Feature 559). The burial is described in more detail later in this report. No special clustering of features are noted (Tables 14 and 15) and several features of different types overlap. The mix of feature types and their lack of spatial patterning makes it impossible to note any potential community patterning in this section of the site. The most that can be said is that the distribution of features in this area reflects varied portions of different Clemson Island occupations of the site of unknown duration and intensity.

Figure 25 shows the distribution of features in the western portion of Section 1 and the feature density is not as great as in other areas. This area also has the lowest variety of feature types. Feature 3, which was originally discovered and excavated during the Phase II excavations is located in this section of the site. No special clustering of features is noted (Tables 14 and 15) and no features overlap. The mix of feature types and their lack of spatial patterning makes it impossible to note any potential community patterning in this section of the site. The most that can be said is that the distribution of features in this area reflects varied portions of different Clemson Island occupations of the site of unknown duration and intensity.

The distribution of features in the eastern half of Section 3 is shown in Figure 26. This is the most interesting of the areas with regard to the study of Clemson Island community patterns because it has numerous post mold patterns that seem to represent the remains of a stockade (Figure 53) and a house (Figure 54 - House A). A second house (Figure 54 - House B) may also be inferred from a short line of tightly spaced post molds, but its existence is more problematic. The area also contains a the largest proportion of Type I smudge pits in small clusters of any of the areas and a large platform hearth (Feature 55) within a shallow Type II pit. However, some Contact features are present and complicate the analysis of the feature

FIGURE 53

Post Mold Pattern - Eastern Half of Section 3

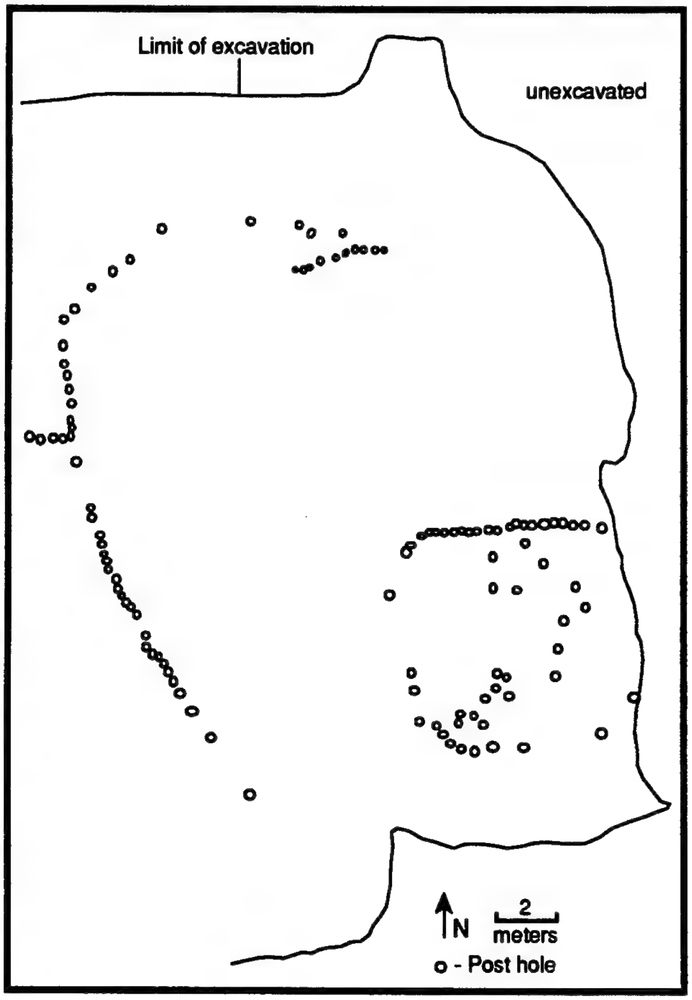


FIGURE 54

Inferred Structure and Stockade Pattern - Eastern Half of Section 3

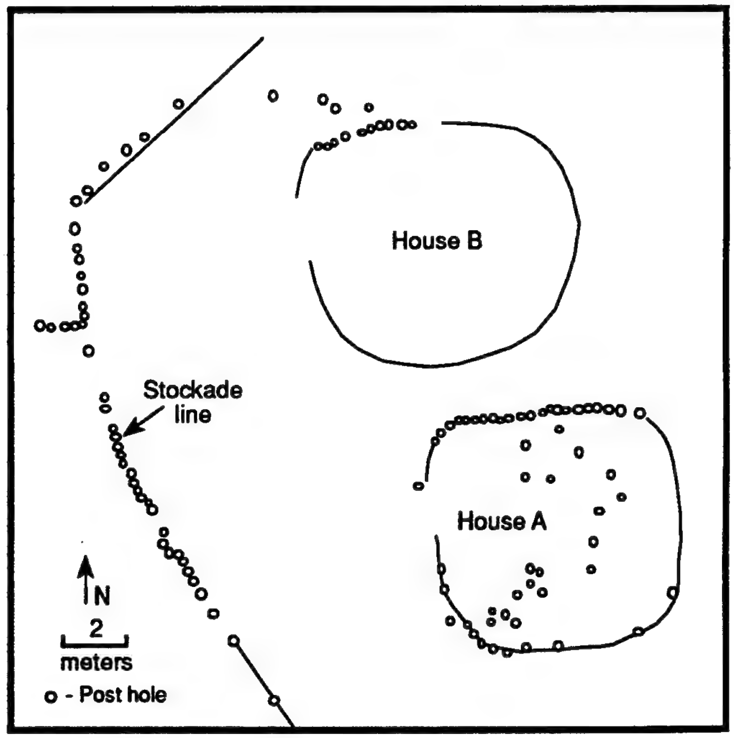
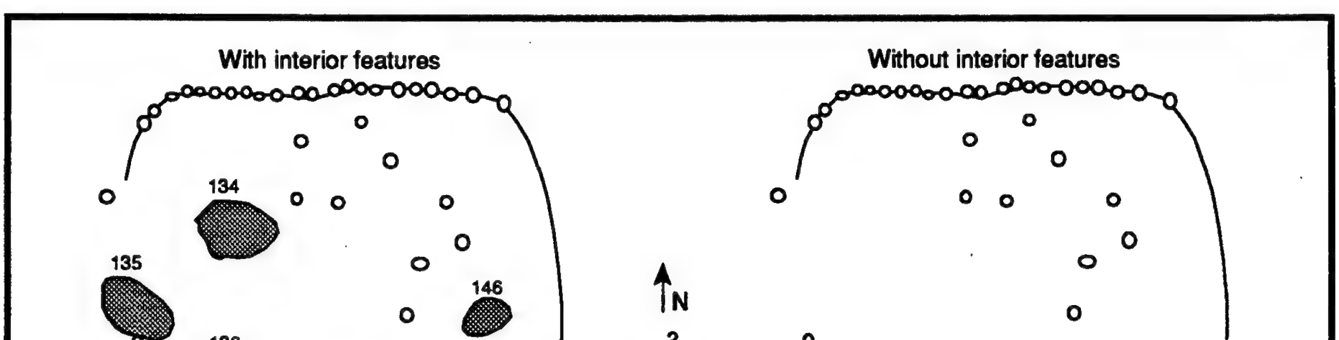


FIGURE 55

House A - Clemson Island Component



distributions. On the other hand, the number of overlapping features in this area of the site is lower than that seen in other areas.

Figure 53 shows the post molds located in the eastern portion of Section 3 in relation to the limits of excavations. Unfortunately, a modern building, the Meyer House, was located directly to the east of the excavations and its construction certainly destroyed any other post mold patterns in this area of the site. Figure 54 shows the interpretation of the post mold configurations as two houses and a stockade, or fence. The stockade line is composed of posts 2-4" in diameter and spaced 3-6" apart. As has been noted in analysis of stockades at Shenks Ferry Sites (Custer et al. 1993), this structure would not have been a stockade in the popular sense of the word where one envisions a frontier palisade of large logs tightly packed next to one another. Rather, the Clemson Island stockade at the West Water Street Site would have probably been a wicker-work of loosely spaced, and rather narrow, upright posts with an interwoven lattice-work of smaller saplings and branches. The effect would have been more like living in a "basket" rather than a "fort." Similar stockade arrangements have been noted at numerous Late Woodland sites in the Susquehanna Valley including the nearby Quiggle Site (Smith 1984), which is slightly younger than the West Water Street Site, and the Airport II site (Garrahan 1990), which is roughly comparable in age to the West Water Street Site and located near Wilkes Barre.

Based on the relatively small portion of the stockade that was preserved and excavated, it is impossible to tell just how big an area it enclosed. There does seem to be a corner, or at least a pronounced curve, in the post line that separates two lines, one of which runs to the east northeast and one of which runs to the south southeast. However, neither of these lines shows any signs of curving before they run into areas that were not excavated. Thus, this stockade could have enclosed a small area of only a few houses, or a large village. Indeed, it has already been suggested in this report that the community enclosed within this stockade could have extended 500' (165 m) to include the dense cluster of storage features in the eastern portion of Segment 1 (Figure 23). Unfortunately, we will never know due to the presence of the modern Meyer house in the middle of the potential village area and the limits of the excavations imposed by the mitigation project.

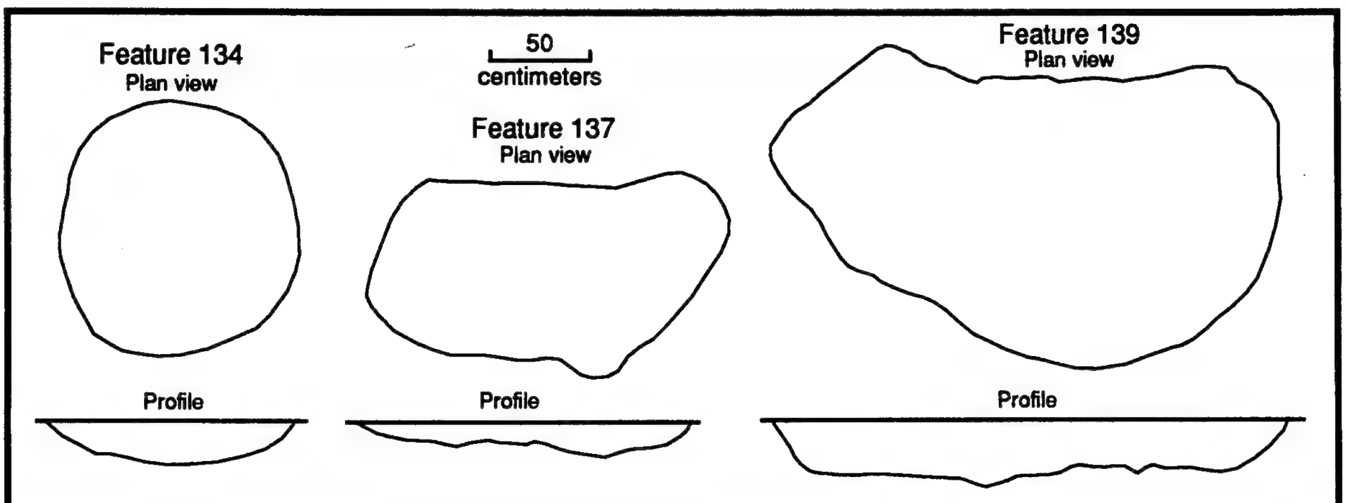
A final interesting feature of the stockade line is a small right angle projection of four posts located midway down the line of post molds. There does seem to be a small opening in the main line of post molds at this point and this opening could be an entrance. It is also possible that the right-angle projection was part of some kind of bastion structure as has been proposed for similar features of stockades at the Murry Site (Kinsey and Graybill 1971) and the Schacht Site (Smith 1973:46).

TABLE 17
Summary Description of Clemson Island and Owasco Houses

Site	Shape	Dimensions (in meters)	Area	Inferred Population*	References
Clemson Island Houses					
Airport II	oblong	11.2 x 5.5	61.6	12	Garrahan 1990:6
	oblong	11 x 5	55.0	12	Garrahan 1990:6
	oval	13.7 x 4	54.8	12	Garrahan 1990:6
	circular	4.5	15.9	7	Garrahan 1990:6
Ramm	rectangular	6.7 x 6	40.2	10	Smith 1976:7
Saint Anthony	oval	4.9	18.8	8	Stewart 1990:93
36LY34	rectangular	10.6 x 29	307.4	39	Turnbaugh 1977:217
Shermans Creek	oval	3.7 x 6.4	23.7	8	Stewart 1990:93
Workman	rectangular	4.3 x 7.9	34.0	9	Kolb and Huner 1968:160,163
Memorial Park	circular	6.25	30.7	9	Hart 1993b:Figure 23
	circular	7.3	41.8	10	Hart 1993b:Figure 23
Owasco Houses					
Roundtop	longhouse	24 x 7.9	189.6	26	Ritchie and Funk 1973:185
	longhouse	22 x 6.6	145.2	21	Ritchie and Funk 1973:185
Maxon-Derby	longhouse	18 x 7.6	136.8	21	Ritchie and Funk 1973:203
	oblong	9.1 x 7	63.7	13	Ritchie and Funk 1973:203
	rectangle	6.9 x 7	48.3	11	Ritchie and Funk 1973:203
Sackett	ovate	3.6 x 3.6	13.0	7	Ritchie and Funk 1973:217
	circular	3.6	10.2	7	Ritchie and Funk 1973:218
	ovate	3.3 x 3	9.9	7	Ritchie and Funk 1973:218
Bates	circular	7.2	40.7	10	Ritchie and Funk 1973:230
Kelso	oblong	8.8 x 6.4	56.3	12	Ritchie and Funk 1973:259
	oval	7.3 x 6	43.8	10	Ritchie and Funk 1973:259
	oblong	7.3 x 6.7	48.9	11	Ritchie and Funk 1973:259
	oval	5.5 x 4.3	23.6	8	Ritchie and Funk 1973:259
	oval	5.8 x 4.9	28.4	9	Ritchie and Funk 1973:259
	oval	6.7 x 5.5	36.8	10	Ritchie and Funk 1973:259
	oval	9.7 x 7.9	76.7	14	Ritchie and Funk 1973:260
	longhouse	38 x 6.7	254.6	33	Ritchie and Funk 1973:260
	longhouse	34 x 6.7	227.8	30	Ritchie and Funk 1973:260
	longhouse	39 x 6.7	261.3	34	Ritchie and Funk 1973:260

*Based on Cook and Heizer (1968). $2.3m^2$ for the first 6 people and $9.24m^2$ for each additional person.

FIGURE 56
Sample Features from House A



Of the two potential houses identified, certainly House A is the most complete. The projection of House B shown in Figure 54 is very conjectural and is based on the inferred line in which the stockade would run and the available space south of the short line of posts that define the small preserved section of House B. Figure 55 shows the outline of House A with the post molds alone and with a series of pit features that were located within the outline of the structure. As outlined in Figure 55, House A would have been roughly square in shape with rounded corners. It would have measured 7.3 m across with an interior area of approximately 53.2 sq. m. Applying the Cook and Heizer (1968) method for determining how many people could have lived within a house with a given floor space, House A could have been the domicile for eleven people. Thus, the house could have been the home for a pair of small nuclear families or a larger extended family.

Table 17 lists a series of descriptive attributes for numerous examples of Clemson Island houses and houses from the Owasco culture of New York. Owasco cultures are included in Table 17 because they are coeval with the Clemson Island culture and based on similarities of pottery designs seem to be closely related through trade and interaction (Stewart 1990; Lucy 1991; Ritchie 1969; Ritchie and Funk 1973). As noted by Stewart (1990:93-95), Clemson Island houses vary quite a bit in size and shape. House A is most similar in shape to houses at the Ramm Site and the Workman Site, but is somewhat larger than these rectangular houses. The mean area of the houses listed in Table 17 was calculated to be 37.6 sq. m, with the very large house at 36LY34 excluded from the calculation due to the fact that it may indeed be a Shenks Ferry house (see Stewart 1990:93). House A falls in the larger end of the size range and is larger than the average. Based on various analyses, numerous researchers (Custer et al. 1993; Ritchie and Funk 1973:261-262) have suggested that as the Late Woodland Period progressed, larger houses were built to accommodate increasingly large matrilineal extended families. The end result of this size increase over time is the Iroquoian longhouse. If this scenario is correct, then the larger size of House A may indicate that it dates to the later portion of the Clemson island chronological sequence.

Table 17 also lists data on a series of houses found at Owasco sites in New York. As was noted earlier, the Owasco culture (Ritchie 1969; Ritchie and Funk 1973; Lucy 1991) dates to the same time period as Clemson Island cultures and is closely related based on similarities in ceramics (Stewart 1990). As was the case with Clemson Island houses, Owasco houses show a great deal of variation in size and shape and House A fits well within these ranges. In sum, House A matches well with other known Clemson and Owasco houses in terms of size and shape.

A series of pit features were found in association with House A and their locations are illustrated in Figure 55. Given the previously noted problems with the context of the Clemson Island component, it is difficult to know for certain if the pit

TABLE 19
Features Within Stockade Area

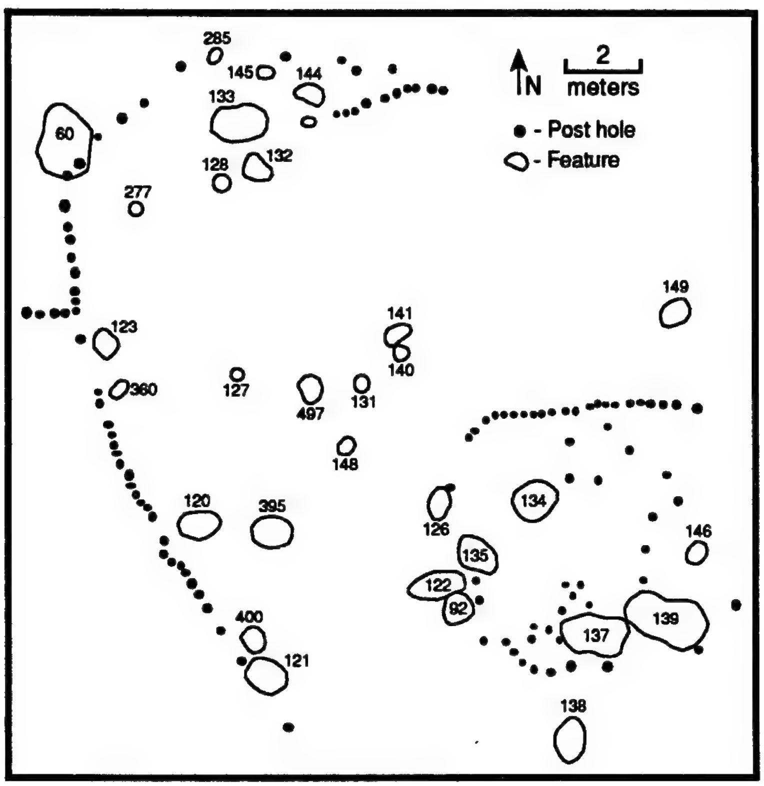
Feature Number	Feature Type	Artifacts: Fire-Cracked Rock	Debitage	Ceramics
60	II	yes	51	yes
120	III	yes	231	yes
121	III	no	4	yes
123	III	yes	24	yes
127	I	no	0	no
128	I	no	1	no
131	I	no	0	no
132	VI	yes	1	no
133	VI	no	2	no
138	VI	no	1	no
140	VI	no	0	yes
141	III	yes	6	yes
144	VI	yes	188	yes
145	III	no	0	no
148	IA	no	0	no
149	IV	yes	233	yes
277	Post	no	0	no
285	I	no	0	no
360	?	yes	0	no
395	III	yes	42	yes
400	?	no	0	no
497	?	yes	45	yes

TABLE 18
Features Associated with House A

Feature Number	Feature Type	Artifacts: Fire-Cracked Rock	Debitage	Ceramics
134	III	yes	4	no
136	VI	no	0	no
137	VI	yes	34	no
139	IX	yes	77	yes
146	III	no	4	no

FIGURE 57

Features within Stockade Area



features would have been associated with the house. With the exception of Feature 135, which is an amorphous shallow feature of uncertain cultural origin, none of the other features are cross-cut by the post mold line of the house wall and may indeed have been part of the house. The remaining features are all very shallow (Figure 56) and some contained fire-cracked rock and debitage (Table 18). It is possible that these features represent interior hearths or some kind of processing features. Cordell (1984) has suggested that the presence of interior hearths indicates that houses were occupied during cold-weather months and House A may have been occupied during the winter months. The presence of debitage suggests that flint knapping activities took place within the structure and the presence of such activities within the house also supports the notion of a cold-weather occupation.

It should be noted that interior features are known from a variety of Clemson Island and Owasco houses. Although the association is somewhat problematic, Garrahan (1990) feels that several deeper storage pits and shallow hearths may have been associated with at least one of the Clemson Island houses at the Airport Site. Ritchie and Funk (1973:216, 227) note the presence of storage pits and hearths within Owasco houses of various shapes and sizes and Kraft (1975:76-77) described interior storage pits of various sizes in Pahaquarra Phase houses of the Upper Delaware Valley which date to the same time period as the Clemson Island culture. The presence of interior features at other comparably dated sites underscores the likelihood that the features associated with House A were indeed used by the site's inhabitants. It is interesting to note, however, that storage features are often found in other Late Woodland houses. Such features are missing from House A suggesting that storage took place outside the structure in more specialized pit facilities.

Just as it is difficult to know if the features within House A were actually associated with the house, it is difficult to know if the features located within the stockade are associated with the community defined by the stockade. However, some comments on features within the stockade can be made. Figure 57 shows the distribution of features within the stockade and Table 19 summarizes the information on those features. A variety of feature types are present, but no Type V storage features are present. The absence of storage features within the houses and within the exposed area of the stockade suggest that storage took place in more specialized area, such as the eastern portion of Section 1.

A number of Type I/IA smudge pit features are present within the stockade area (Figure 58) and in the central part of this area, to the northwest of House A, these features are associated with several hearth features. The same areas also include features with substantial amounts of debitage (Figure 59). Based on the associations of these features a series of activity areas can be projected (Figure 60). Two general work areas which may have been associated with activities such as hide preparation and

FIGURE 58

Feature Function Distribution Within Stockade

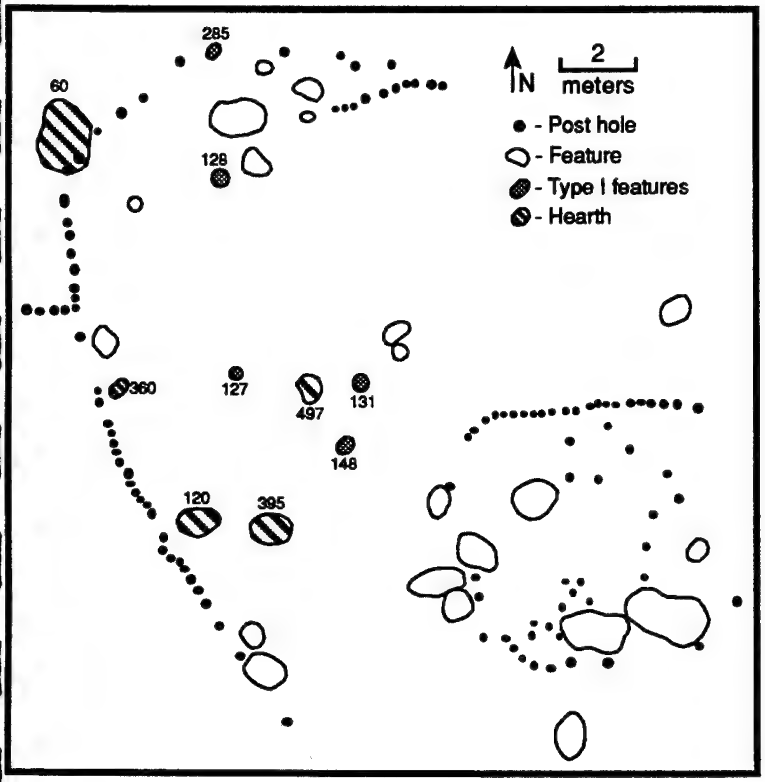


FIGURE 59

Features with Significant Amounts of Debitage

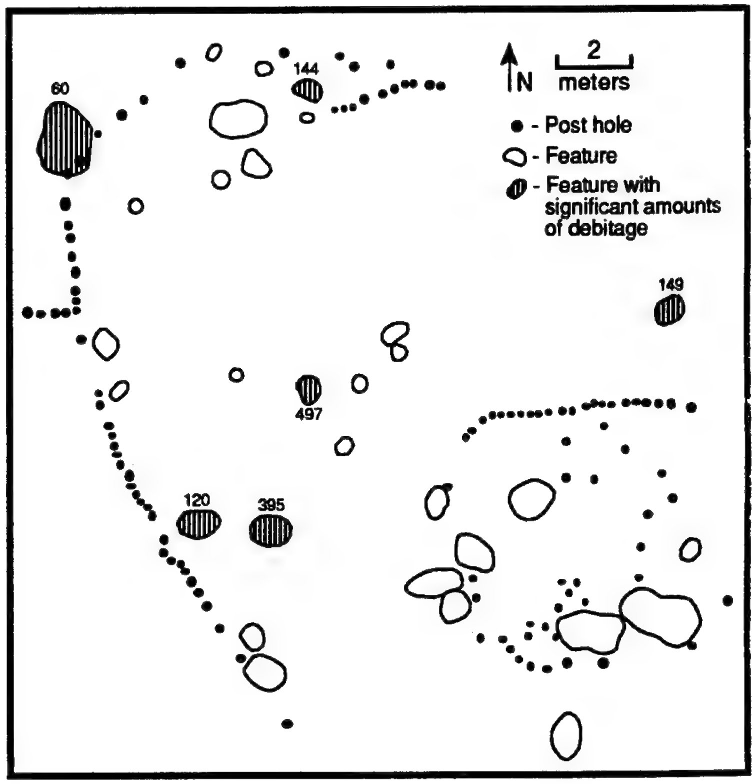
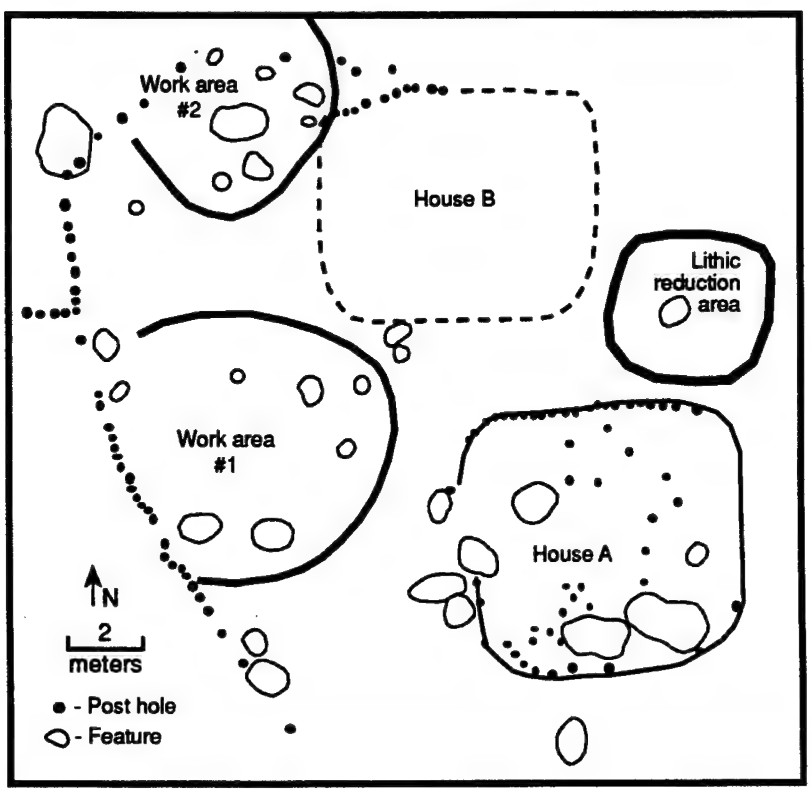


FIGURE 60

Activity Areas



processing, stone tool manufacturing, and generalized processing activities can be defined. These areas are located along the stockade line to the west of the houses. An additional lithic reduction area may be present just to the north of House A. The association of individual work areas with the two houses suggest that activities were organized on an individual family basis rather than on a communal basis. However, storage of food resources seem to have been more specialized and may have had a communal basis. Hay, Hatch, and Sutton (1987) have suggested that work/storage areas were spatially segregated from living areas. However, the data from the West Water Street Site would indicate that only some activity areas were spatially segregated.

To summarize the discussion of the stockade area of the eastern half of Section 3, a portion of a small Clemson Island community was exposed and identified. One house is clearly present and second can be projected. The segment of the stockade exposed was small and it is not clear if the stockade enclosed a small hamlet or if is part of a larger community. Interior hearths suggest an occupation spanning the winter months and individual family work areas are associated with the houses. No storage features are associated with exposed stockade area, but could be present in other unexcavated areas of the site.

The remainder of the eastern half of Section 3 outside of the stockade area contains a mix of a variety of feature types as well as several Contact Period features (Figure 26). The feature density is not as great as in other areas. The mix of feature types and their lack of spatial patterning makes it impossible to note any potential community patterning in this section of the site; however, the large platform hearth (Feature 55) does suggest the presence of a specialized processing area. The most that can be said is that the distribution of features in this area reflects varied portions of different Clemson Island occupations of the site of unknown duration and intensity.

Figure 27 shows the distribution of features in the western half of Section 3 and the feature density is not as great as in other areas. A variety of feature types are present including a cluster of Type I smudge pits in the central section of this area. Numerous Contact Period features are also present in this area and complicate the recognition of Clemson Island community patterning among the feature distributions. No special clustering of features is noted (Tables 14 and 15). Few features of different types overlap. The mix of feature types and their lack of spatial patterning makes it impossible to note any potential community patterning in this section of the site. The most that can be said is that the distribution of features in this area reflects varied portions of different Clemson Island occupations of the site of unknown duration and intensity.

Chronology

Ceramics. Ceramics are the major diagnostic Clemson Island artifacts from the West Water Street Site that can be used to

consider the chronology of the community patterns noted above. In general, ceramics could be used to answer two main chronological questions: 1) What is the age of the community pattern within the Clemson Island chronology?; and, 2) Is there reason to believe that the features identified as part of a single community pattern are not contemporaneous? Answering either of these questions requires the assumption that the association of ceramics in a feature is not a result of post-depositional mixing. And, it has been shown that such an assumption is in no way valid for any of the features in the Clemson Island component at the Water Street Site. Nevertheless, by considering sets of features which are not cross-cut by other features, and which do not contain diagnostic artifacts from earlier time periods, tentative answers to the questions noted above can be determined. However, it is important to remember that any answers to chronological questions for the West Water Street Site Clemson Island component must remain tentative.

The search for answers to the chronological questions noted above also assumes that there is an agreed-upon Clemson Island chronological ceramic sequence to provide a framework for such studies. This assumption would be just as erroneous as the assumption that the contents of Clemson Island features at the West Water Street Site must represent single points in time. There is a great deal of disagreement on Clemson Island chronologies based on ceramic types as evidenced by the discussion of this issue in two major overviews of Clemson Island studies (Stewart 1990; Hay, Hatch, and Sutton 1987). Furthermore, an additional different interpretation of the Clemson Island ceramic sequence has recently been proposed by Hart (1993b). Given this disagreement, a brief discussion of the Clemson Island chronological sequence to be used in this analysis is presented below before discussing the ceramics from the West Water Street Site.

Review of the literature on Clemson Island ceramic studies and their implications for developing Clemson Island chronologies reveals two somewhat conflicting viewpoints. Hay, Hatch, and Sutton (1987) and Hart (1993a) take the position that there are various restricted mixes of Clemson Island pottery varieties that have chronological meanings. They both define a relatively large number of Clemson Island pottery types which mirror the related Owasco types of New York State (Ritchie and MacNeish 1949). These Clemson Island types are then assigned putative chronological meaning based on the Owasco sequence. These chronological meanings are then assessed in light of associated radiocarbon dates. If the radiocarbon dates and assemblages of Clemson Island ceramic sherds match the Owasco sequence and the expected mix of ceramic types hypothesized in their Clemson Island typology, then the chronological sequence is seen as validated, and the co-occurrence of various Clemson Island ceramic types is used to assign ranges of dates to features that do not have radiocarbon dates. If the mix of Clemson Island ceramic types and associated dates do not match the hypothesized sequence, then the association is discounted and not considered

to be a valid test of their hypothesized chronology. Clearly, in this kind of approach their hypothesized chronology will never be contradicted and will always be confirmed because any contrary evidence can be dismissed as the result of disturbance, and usually is. Such an approach to chronological study can be described as a "typology-derived," or normative, approach where the archaeological record is viewed as having little variation at single points in time and typological schemes as assumed to be correct and are used to evaluate archaeological contexts.

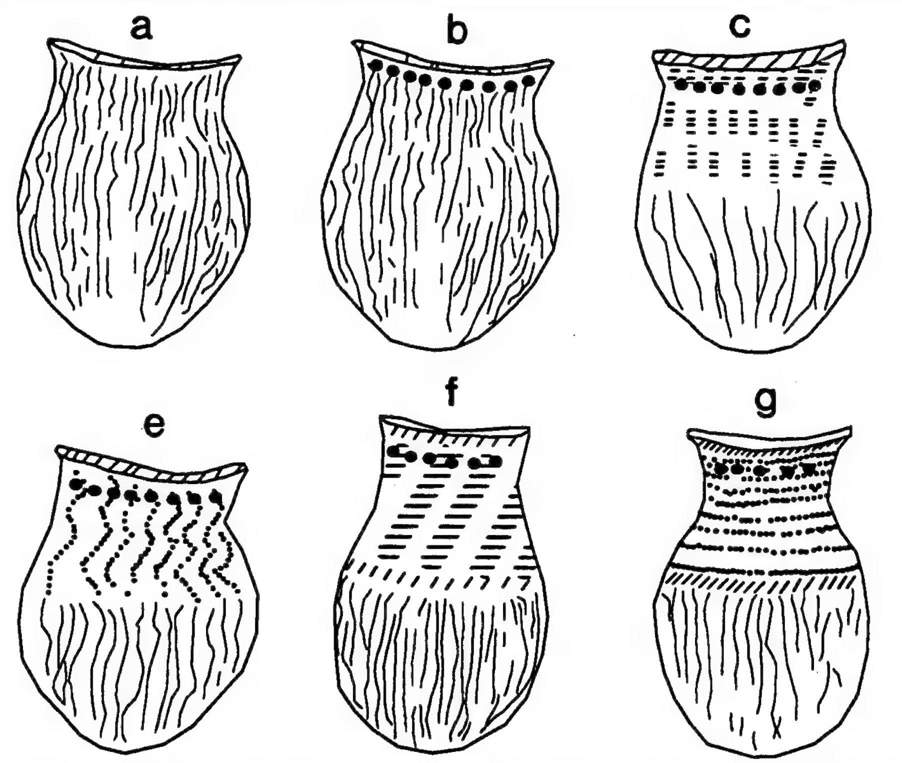
Normative chronological studies are commonly used in all time periods in Middle Atlantic archaeology and do have their uses. For example, we have used a normative approach to a certain extent in assessing the contextual integrity of the Clemson Island component at the West Water Street Site. We have assumed that our broad cultural typology lets us recognize Susquehanna broadspears as distinctive artifacts used no later than 700 B.C., and that these artifacts should not be found in association with Clemson Island ceramics postdating A.D. 700. When these two differently dated artifacts are found together, we know the context is disturbed. The difference between our use of a normative approach and that used by Hart (1993b) and Hay, Hatch, and Sutton (1987) is that we are looking at time scales on the order of millennia and they are looking at time scales on the order of centuries and decades. Furthermore, we are using consistent chronological data from throughout the Northeastern United States and they are looking at a much smaller region in the Upper Susquehanna River Valley. The finer time distinctions and smaller region of applicability of a normative approach to Clemson Island ceramics lead to problems and the circular reasoning noted above. Similar problems have been encountered in normative approaches to projectile point typologies during the Archaic and Woodland Periods in the Middle Atlantic region (see discussion in Evans and Custer 1990).

Stewart's (1990) approach to Clemson Island ceramic typologies and chronological issues is somewhat different and has led him to different conclusions. He uses a typological system similar to that used by Hart (1993b) and Hay, Hatch, and Sutton (1987); however, he does not assign inviolable chronological meaning to the types based on their similarities with the New York Owasco system. Rather, Stewart uses the types as organizing and descriptive devices only. In applying the ceramic typology to the study of the Saint Anthony Site in Lewisburg, Stewart (1988) first considered the context of the features and archaeological deposits without using the ceramic typology itself. Looking at geomorphological context, feature relationships, refitted artifacts, and individual ceramic vessel distributions among features, Stewart was able to do what we are unable to at West Water Street - clearly identify an undisturbed archaeological context from a limited point in time.

After such a context was identified without the use of the ceramic typology, Stewart reviewed the co-occurrence of Clemson Island types within what he believed to be a single point in time

FIGURE 61

Clemson Island Ceramic Types



a - Clemson Island/ Levanna Cord-on-Cord
b - Clemson Island/Levanna Cord-on-Cord: Punctated
c - Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
d - Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
e - Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
f - Clemson Island/Carpenter Brook/ Owasco: Platted
g - Clemson Island/Owasco Corded Horizontal

and found that many of the ceramic types defined by Hay as having limited non-overlapping time distributions were found to occur together. Because he was so sure of the context of the Saint Anthony Site, Stewart did not dismiss the unexpected co-occurrence of the types as the result of site disturbance. Instead he advanced the hypothesis that at any given time numerous Clemson Island ceramic types can co-occur and the chronological sensitivity of the types described by Hay, Hatch, and Sutton (1987) and Hart (1993b) was not as clear-cut as they propose. Stewart's approach can be described as "context-derived" and in our opinion is a more fruitful approach that more realistically recognizes the variability of material culture.

For our purposes here we will use a chronological typology of Clemson Island ceramics derived from the work of Stewart (1988, 1990) and Hatch (1980) and linked to the New York sequence illustrated by MacNeish (1952; Ritchie and MacNeish 1949). As an aside, it is interesting to note that Hatch (1980) derived the basic Clemson Island ceramic chronology sequence that spawned the typological approach of Hay, Hatch, and Sutton (1987) using a "context-based" approach to the study of ceramics from Fisher Farm.

Figure 61 depicts a series of core Clemson Island ceramic types that could date to any time period between A.D. 1000 and A.D. 1200 based on Stewart's (1988) work at the Saint Anthony Site. Other varieties noted in the typology proposed by Hay,

Hatch, and Sutton (1987) are viewed as variants of these basic types or idiosyncratic variants that do not occur in sufficient quantities to necessitate specific type names. The ceramic varieties illustrated in Figure 61 may also characterize Clemson Island assemblages pre-dating A.D. 1000 if they are associated with both Jack's Reef pentagonal points and the triangular points, as seems to be the case at the Memorial Park Site (Hart 1993b:192). The Memorial Park Site data also seem to indicate that the simple Clemson Island/Levanna Cord-on-Cord, and Clemson Island/Carpenter Brook corded horizontal would be the most common types in assemblages predating A.D. 1000. Furthermore, the earlier assemblages would be more likely to have cord-marked rim interiors and exteriors and fewer decorated lips (Hart 1993b:46). Based on the work of Hatch (1980), Clemson Island ceramic assemblages post-dating A.D. 1100 would contain the same mix of types illustrated in Figure 61, but would also include examples of Shenks Ferry ceramic types such as Shenks Ferry Cordmarked, Shenks Ferry Incised (Simple Sub-type), Shenks Ferry Complex Incised, and Shenks Ferry Compound Decorated (Heisey 1971; Witthoft 1954).

Before applying the chronological sequence noted above to the West Water Street Site, it is important to note that no Jack's Reef pentagonal points were found at the site. Therefore, given the disturbed feature contexts, we cannot hope to unequivocally identify any pre-A.D. 1000 components at the site. However, the absence of the Jack's Reef points, which are commonly associated with early Owasco and late Point Peninsula components in New York (Ritchie 1969) and at the Memorial Park Site (Hart 1993b:192), implies that the majority of the Clemson Island components at the West Water Street Site post-date A.D. 1000.

Application of the Clemson Island ceramic typology to chronological issues at the West Water Street Site involved the identification of individual ceramic vessels through the analysis of rim sherds from excavated features. Vessels were identified on the basis of distinctive rim treatments, including rim shape and decoration, idiosyncratic attributes of the punctates that characterize Clemson Island ceramics, decorative motifs, refitted sherds, and surface treatments. For the most part, individual vessel identification focused on rim sherds; however, in some cased body sherds were also used. Ceramics from both disturbed and undisturbed features were analyzed; however, undisturbed features provide the best chance for obtaining useful chronological information. In considering the "undisturbed" features, it is important to remember that the terms "disturbed" and "undisturbed" are relative. The disturbed features are ones where the presence of pre-Late Woodland artifacts or other cross-cutting features clearly show that the contents of the pit do <u>not</u> represent a short time interval. The "undisturbed" features do not have such clear cut signs of disturbance, but, given the high proportion of disturbed features throughout the site, these features are very likely to be disturbed as well. In the case of the "undisturbed" feature we just do not have the signs of

TABLE 20
Ceramic Vessels from Undisturbed Features - Section 1

Vessel number	Feature number	Type
1	173	Clemson Island/Levanna Cord-on-Cord: Punctated
2	177	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
3	177	Clemson Island/Levanna Cord-on-Cord
4	187	Clemson Island/Owasco Corded Horizontal
5	187	Bainbridge Notched Lip (?)
6	193	Clemson Island/Levanna Cord-on-Cord
7	194C	Clemson Island/Levanna Cord-on-Cord
8	194C	Clemson Island/Levanna Cord-on-Cord
9	194C	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
10	196	Clemson Island/Levanna Cord-on-Cord
11	196	Clemson Island/Levanna Cord-on-Cord: Punctated
12	196	Clemson Island/Levanna Cord-on-Cord: Punctated
13	196	Clemson Island/Levanna Cord-on-Cord: Punctated
14	198	Owasco Herringbone
15	198	Clemson Island/Levanna Cord-on-Cord: Punctated
16	202	Clemson Island/Levanna Cord-on-Cord (?)
17	205	Clemson Island/Levanna Cord-on-Cord: Punctated (?)
18	208	?
19	235	Clemson Island/Owasco Corded Horizontal
20	235	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
21	235	pinch pot (?)
22	235	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
23	235	?
24	235	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
25	235	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
26	235	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
27	235	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
28	235	Clemson Island/Levanna Cord-on-Cord: Punctated
29	235	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
30	235	Clemson Island/Levanna Cord-on-Cord: Punctated
31	235B	Clemson Island/Levanna Cord-on-Cord: Punctated
32	236	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
33	236	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
34	236	Clemson Island/Levanna Cord-on-Cord: Punctated
35	236	?
36	556	Clemson Island/Levanna Cord-on-Cord: Punctated
37	557	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
38	557	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
39	557	Clemson Island/ Carpenter Brook Cord-on-Cord: Platted
40	563	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
41	563	?
42	563	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
43	563	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
44	563	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique
45	563	?
46	564	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horiontal
47	579	Clemson Island/Levanna Cord-on-Cord: Punctated
48	579	Clemson Island/Owasco Corded Horizontal
49	585	Schultz Incised - Susquehannock
50	605	Clemson Island/Levanna Cord-on-Cord: Punctated
51	605	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
52	605	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
53	607	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
54	607	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
55	693	Shenks Ferry Multiple Banded
56	693	Shenks Ferry (?)

TABLE 21
Ceramic Vessels from Undisturbed Features - Section 3

Vessel number	Feature number	Type
1	26	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
2	104	Clemson Island/Levanna Cord-on-Cord
3	101	?
4	101	?
5	101	Clemson Island/Levanna Cord-on-Cord: Punctated
6	101	Clemson Island/Levanna Cord-on-Cord
7	120	?
8	124	Clemson Island/Owasco Corded Horizontal
9	147	Clemson Island/Owasco Corded Horizontal
10	147	Clemson Island/Levanna Cord-on-Cord
11	149	Clemson Island/Levanna Cord-on-Cord
12	149	Clemson Island/Levanna Cord-on-Cord: Punctated
13	395	Clemson Island/Levanna Cord-on-Cord: Punctated
14	395	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
15	503	Clemson Island/Levanna Cord-on-Cord: Punctated
16	503	Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone
17	542	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
18	542	Clemson Island/Levanna Cord-on-Cord: Punctated
19	542	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
20	542	Clemson Island/Carpenter Brook Cord-on-Cord: Platted
21	542	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
22	542	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal
23	542	Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal

TABLE 22
Ceramic Type Counts

	Section 1 Undisturbed	Section 3 Undisturbed	Section 1 Disturbed	Section 3 Disturbed	Section 1 Total	Section 3 Total	Grand Total
Clemson Island/Levanna Cord-on-Cord	6	4	13	13	19	17	36
Clemson Island/Levanna Cord-on-Cord: Punctated	13	5	16	7	29	12	41
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique	6	0	2	0	8	0	8
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal	12	6	8	2	20	8	28
Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone	4	2	1	0	5	2	7
Clemson Island/Carpenter Brook Cord-on-Cord: Platted	1	1	3	0	4	1	5
Clemson Island/Owasco: Corded Horizontal	3	2	1	0	4	2	6
Unidentified	6	3	2	9	8	12	20
Bainbridge Notched Lip	1	0	0	1	1	1	2
Owasco Herringbone	1	0	0	0	1	0	1
Schultz Incised	1	0	0	0	1	0	1
Shenks Ferry (Multipel banded)	2	0	0	4	2	4	6
Shenks Ferry Incesed	0	0	3	5	3	5	8
Smoothed	0	0	0	11	0	11	11
Jack's Reef Criss-Cross	0	0	0	1	0	1	1
Total	56	23	49	53	105	76	181

TABLE 23
Ceramic Type Percentages - Section 1

	Undisturbed	Disturbed	All Features
Clemson Island/Levanna Cord-on-Cord	13	27	20
Clemson Island/Levanna Cord-on-Cord: Punctated	28	34	31
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique	13	4	9
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal	25	17	21
Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone	8	2	5
Clemson Island/Carpenter Brook/Owasco: Platted	2	6	4
Clemson Island/Owasco: Corded Horizontal	6	2	4
Shenks Ferry	4	6	5

TABLE 24
Ceramic Type Percentages - Section 3 and Total Site

	Undisturbed	Disturbed	All Features	Site Total
Clemson Island/Levanna Cord-on-Cord	25	45	33	25
Clemson Island/Levanna Cord-on-Cord: Punctated	31	24	23	28
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique	0	0	0	6
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal	37	7	16	19
Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone	13	0	4	5
Clemson Island/Carpenter Brook/Owasco: Platted	6	0	2	3
Clemson Island/Owasco: Corded Horizontal	13	0	4	4
Shenks Ferry	0	31	17	9

disturbance. It might be best to think of them as features with no overt signs of disturbance.

Tables 20 and 21 list the vessels identified from the undisturbed features in Sections 1 and 3. Table 22 summarizes the variety of types identified in both the disturbed and undisturbed features. Tables 23 and 24 show the percentages of the varied Clemson Island and Shenks Ferry ceramic types and Figure 62 summarizes the same information. Figure 63 shows examples of sherds of each of the main Clemson Island ceramic types found at the West Water Street Site.

Figure 62 clearly shows that Clemson Island/Levanna Cord-on-Cord, Clemson Island/Levanna Cord-on-Cord: Punctated, and Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal are the most prevalent types at the site. Together they account for more than 70% of the identified vessels in each area and in the site as a whole. These three types are often thought of as "early" Clemson Island ceramic types in some of the more traditional typological studies (e.g. - MacNeish 1952). However, Stewart (1988) has shown that they can occur in assemblages that date as late as A.D. 1200. These three types are probably not diagnostic of any specific time interval within the Clemson Island chronology and are the simplest of all of the designs seen in the Clemson Island typology. In Late Woodland ceramic chronologies of other adjacent areas within the Middle Atlantic region, the simplest design motifs often show the greatest stability through

FIGURE 62

Ceramic Type Percentages

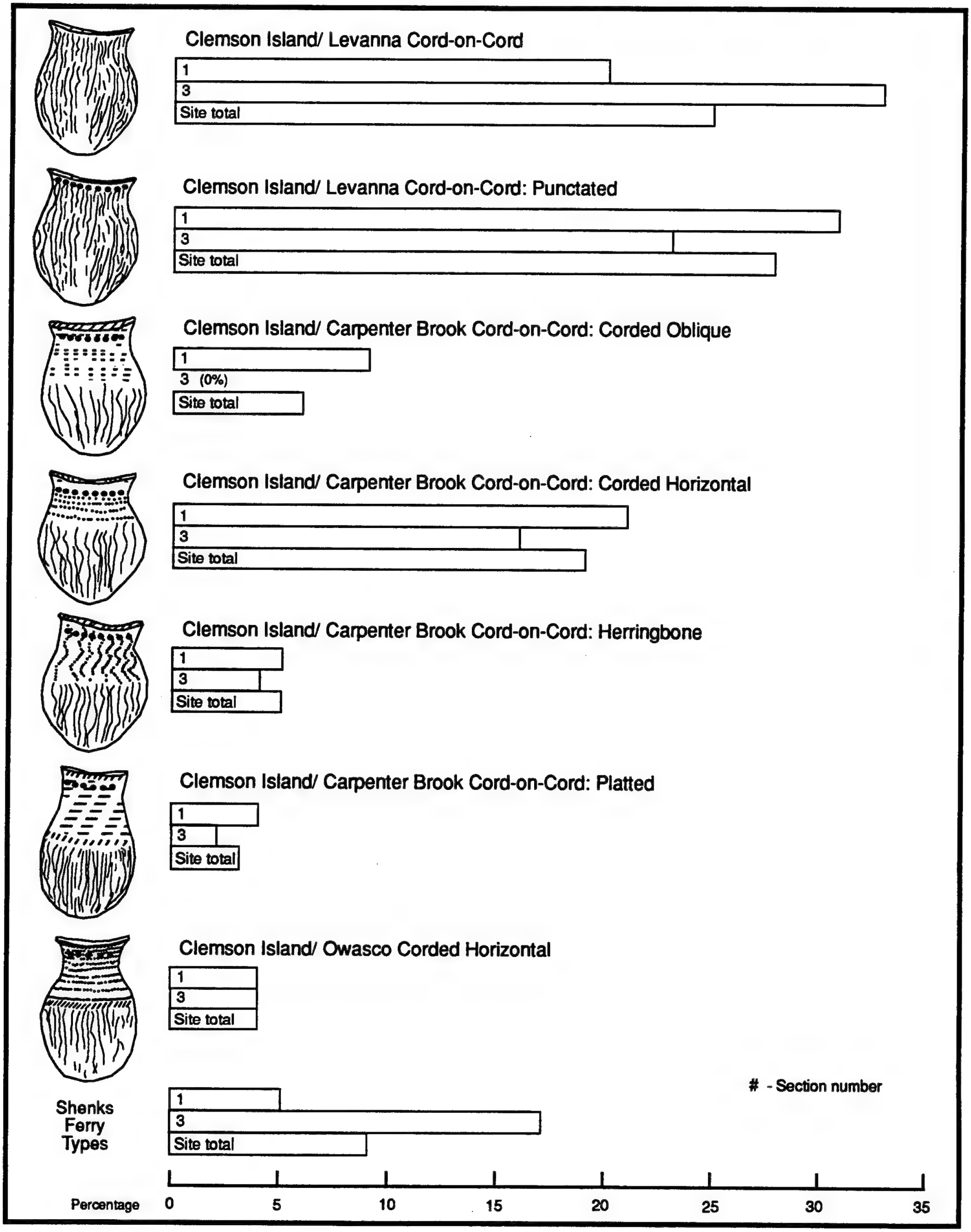
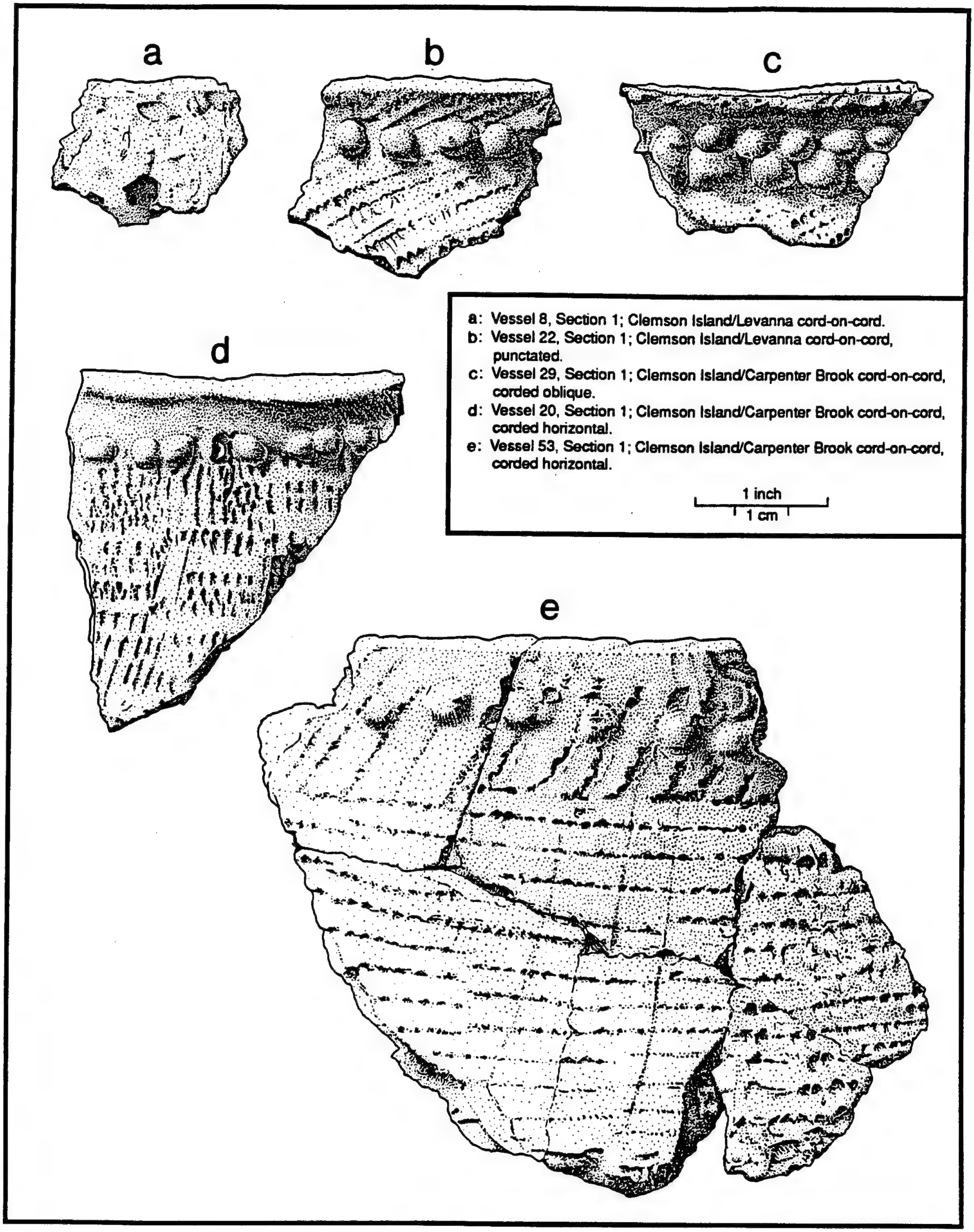


FIGURE 63

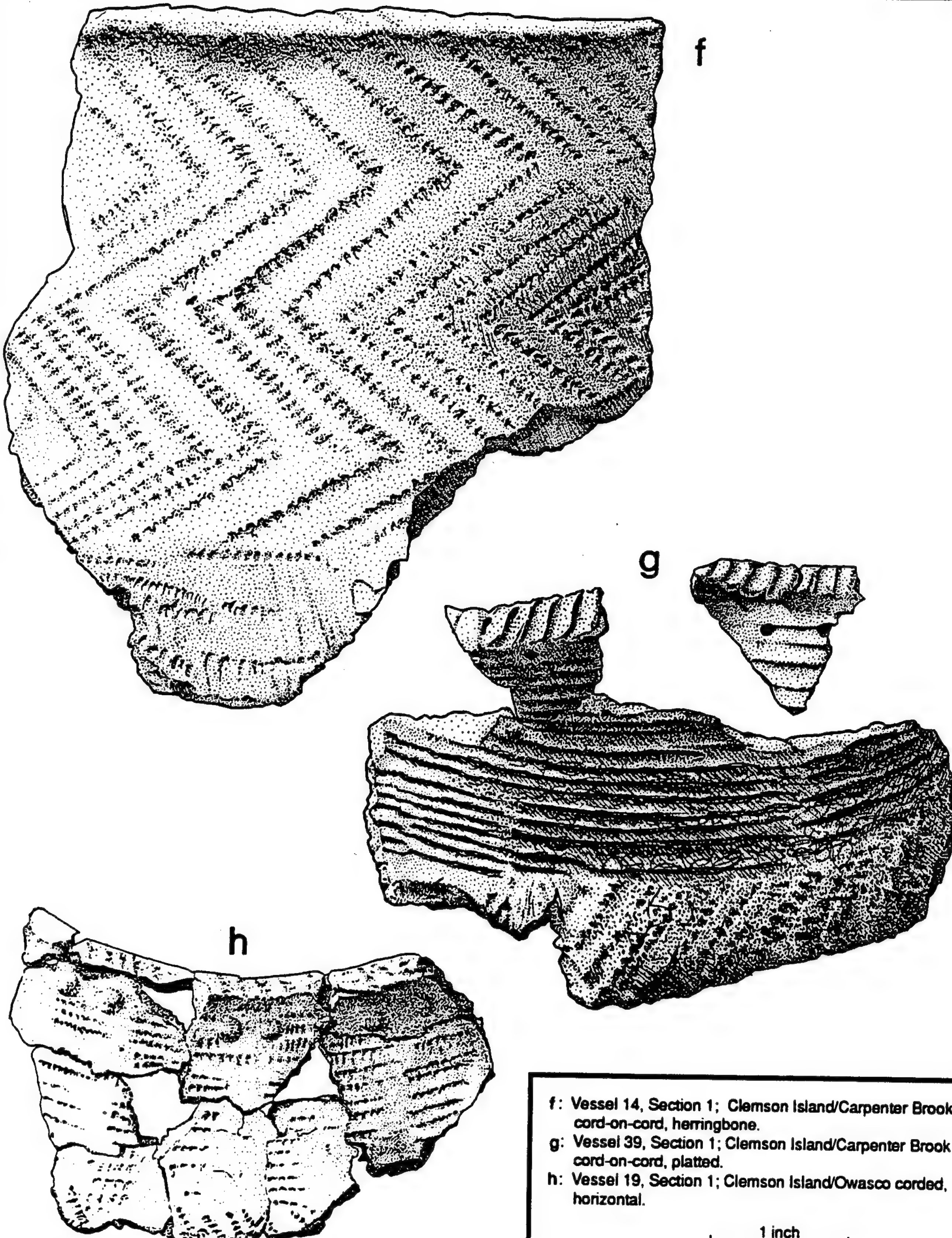
Example Clemson Island Sherds



a: Vessel 8, Section 1; Clemson Island/Levanna cord-on-cord.
b: Vessel 22, Section 1; Clemson Island/Levanna cord-on-cord, punctated.
c: Vessel 29, Section 1; Clemson Island/Carpenter Brook cord-on-cord, corded oblique.
d: Vessel 20, Section 1; Clemson Island/Carpenter Brook cord-on-cord, corded horizontal.
e: Vessel 53, Section 1; Clemson Island/Carpenter Brook cord-on-cord, corded horizontal.

FIGURE 63 (continued)

Example Clemson Island Sherds



f: Vessel 14, Section 1; Clemson Island/Carpenter Brook cord-on-cord, herringbone.

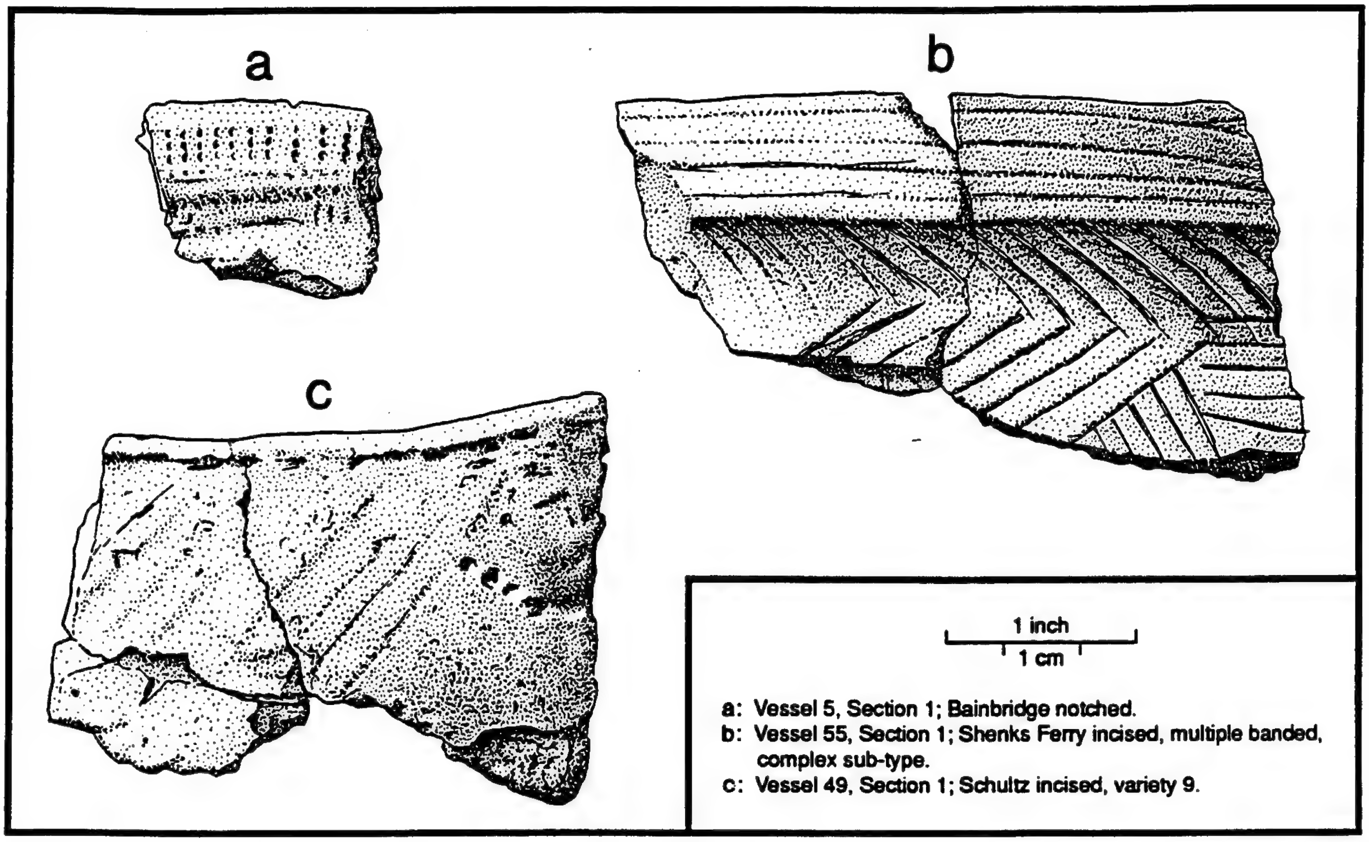
g: Vessel 39, Section 1; Clemson Island/Carpenter Brook cord-on-cord, platted.

h: Vessel 19, Section 1; Clemson Island/Owasco corded, horizontal.

1 inch

1 cm

FIGURE 64
Non-Clemson Island Sherds



a: Vessel 5, Section 1; Bainbridge notched.
b: Vessel 55, Section 1; Shenks Ferry incised, multiple banded, complex sub-type.
c: Vessel 49, Section 1; Schultz incised, variety 9.

time and are not often useful as diagnostic artifacts within ceramic sequences (e.g. - Griffith and Custer 1985). It is suggested here that the same situation holds for the Clemson Island ceramic sequence. Clemson Island/Levanna Cord-on-Cord, Clemson Island/Levanna Cord-on-Cord: Punctated, and Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal are not useful diagnostic ceramic types within the Clemson Island series and will be predominant in Clemson Island ceramic sequences from all time intervals within the Clemson Island sequence. Consequently, 70% of the identified ceramic vessels from the West Water Street Site do not yield useful chronological data for understanding the possible timing of the Clemson Island occupation.

Only one vessel clearly associated with the early portions of the Clemson Island ceramic sequence is present in the ceramic assemblage from the West Water Street Site and it is represented by a very small rim sherd from a Jack's Reef Criss-Cross vessel recovered from a disturbed feature in Section 3. Jack's Reef Criss-Cross ceramics are not well-dated in New York, but are thought to occur in the time period between A.D. 600 and A.D. 900 (Ritchie 1969:228-230) at the end of the Point Peninsula sequence and the beginning of the Owasco sequence. The presence of this single early vessel matches well with the absence of Jack's Reef points in the Clemson Island projectile point assemblage and indicates that most of the Clemson Island occupation of the West Water Street Site does not pre-date A.D. 1000.

A number of ceramic sherds associated with later portions of the Clemson Island sequence are also present. For the most part, these are not Clemson Island pottery types, but rather are types that co-occur with Clemson Island or Owasco types in assemblages that date closer to A.D. 1200 than they do to A.D. 1000. Rim sherds from two Bainbridge Notched vessel are present and one example is shown in Figure 64a. This type is thought to be a "late Owasco type" in the traditional interpretations of the New York sequence (MacNeish 1952; Ritchie and MacNeish 1949) and more recent research (Niemczycki 1984; MacNeish 1980) has supported this inferred date. Fourteen different Shenks Ferry vessels were identified in the West Water Street ceramic assemblage and Figure 64b shows one example of a vessel with a rather complex incised design motif.

Shenks Ferry ceramics are associated with the Stewart Phase occupation of the West Branch of the Susquehanna Valley and this Late Woodland occupation postdates the Clemson Island culture. However, Hatch (1983) notes that there is a slow transition and replacement of Clemson Island ceramics with Shenks Ferry ceramics in this region and Graybill (1989) and Custer (1986b) have suggested that the Stewart Phase Shenks Ferry culture is a direct outgrowth of the Clemson Island culture. Twelve of the Shenks Ferry vessels from the West Water Street Site, representing 86% of the total number of Shenks Ferry vessels, came from disturbed features. Therefore, it is impossible to know whether the features were dug by Late Clemson Island groups using Shenks Ferry pottery, or if they were dug by later Stewart Phase Shenks Ferry groups. The remaining two Shenks Ferry ceramic vessels were associated with Clemson Island body sherds in undisturbed features; however, the previously noted problems with the context of even the undisturbed features makes this association problematic. Even given the problems with assessing the context of the Shenks Ferry ceramics in the assemblage, the very small number of Shenks Ferry vessels, which represent less than 10% of the total vessel assemblage (Table 24), suggests that these ceramics were associated with a late Clemson Island occupation of the site rather than a separate Stewart Phase Shenks Ferry occupation.

In general, the presence of the late Owasco Bainbridge Notched type and the Shenks Ferry ceramic types suggest that at least some of the Clemson Island occupation of the site occurred closer to A.D. 1200 than A.D. 1000. Of the 105 vessels identified in Section 1, the five Shenks Ferry vessels from this area represent 5% of the vessel assemblage (Table 22). In Section 3, there are nine Shenks Ferry vessels from a total assemblage of 76 vessels comprising 12% of the total. Application of a difference-of-proportion test (Parsons 1974) reveals that this difference is not statistically significant (test statistic = 1.75, $.10<p<.05$) and Shenks Ferry vessels are equally prevalent in both sections of the site. The absence of a significant difference would tend not to contradict the notion that at least some portions of the entire site area could have

TABLE 25
Ceramic Types in Stockade and Storage Areas

	Stockade Area Section 3	Storage Area Section 1
Clemson Island/Levanna Cord-on-Cord	1	6
Clemson Island/Levanna Cord-on-Cord: Punctated	2	6
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique	0	1
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal	0	1
Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone	0	0
Clemson Island/Carpenter Brook/Owasco: Platted	0	0
Clemson Island/Owasco: Corded Horizontal	1	1
Unidentified	1	1
Bainbridge Notched Lip	0	1
Owasco Herringbone	0	1

been occupied simultaneously, or at least over a small time interval.

An additional non-Clemson Island vessel worthy of mention is represented by shell-tempered rim and body sherds from a Susquehannock Schultz Incised vessel (Figure 64c). The incised design composed of incised lines and dots most closely resembles Design Type 9 illustrated by Kinsey (1959b:81). Based on Kinsey's (1959b) and Kent's (1984) Susquehannock ceramic chronology, this sherd dates to ca. A.D. 1550 - 1625 and has absolutely nothing to do with the Clemson Island occupation of the site. The Susquehannocks occupied the Susquehanna Valley at the time of initial European Contact in the early 1600s; but were gone from the region as an organized cultural group by 1675. The Susquehannock ceramic sequence is well-dated based on associations with European trade goods and Schultz Incised ceramics were not made after 1625. Therefore, the Schultz Incised vessel at the West Water Street Site is probably related to an ephemeral Susquehannock occupation of the site that occurred after the Clemson Island occupations, but before the more extensive eighteenth century Contact occupation described earlier in this report.

The distribution of ceramic types within two more specific sections of the site is shown in Table 25. Only five individual vessels are present in the stockade area in the eastern half of Section 3 (Figure 26). One of the vessels cannot be identified as a specific type. Three vessels are the more simple Clemson Island/Levanna Cord-on-Cord and Clemson Island/Levanna Cord-on-Cord: Punctated types, and an additional vessel is a Clemson Island/Owasco Corded Horizontal type. None of these types are particularly diagnostic; however, the Clemson Island/Owasco Corded Horizontal type is often viewed as a late Owasco type that dates closer to A.D. 1200 than A.D. 1000 (MacNeish 1952). The presence of this one vessel is a tentative indicator that the occupation of this section of the site dates to the later portion of the Clemson Island period, ca. A.D. 1200. The absence of any Shenks Ferry vessels suggests that the use of this section of the site does not post-date A.D. 1200.

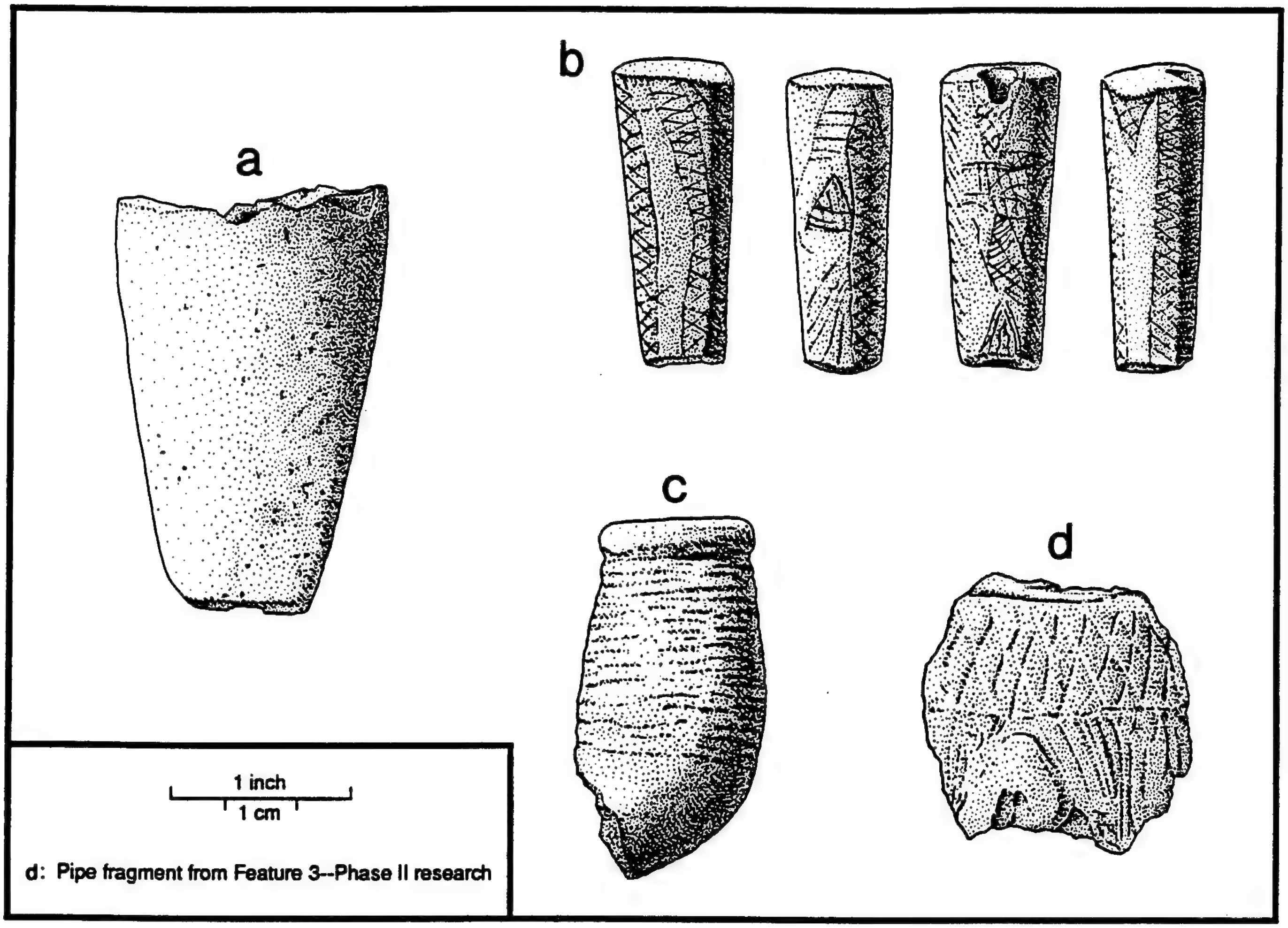
TABLE 26
Ceramic Types in Individual Features

	Section 1						Section 3			
	194C	196	235	236	557	563	101	542	Total	Percent %
Clemson Island/Levanna Cord-on-Cord	2	1					1		4	10
Clemson Island/Levanna Cord-on-Cord: Punctated		3	3	1			1	1	9	21
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique			2			3			5	12
Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal	1		3	1	1			5	11	26
Clemson Island/Carpenter Brook Cord-on-Cord: Herringbone			2	1	1				4	10
Clemson Island/Carpenter Brook/ Owasco: Platted					1			1	2	5
Clemson Island/Owasco: Corded Horizontal			1						1	2
Unidentified			2	1		1	2		6	14

A total of 18 different vessels were identified for the concentration of storage features in eastern portion of Section 1 (Figure 23). Thirteen of the vessels (72%) are non-diagnostic types such as Clemson Island/Levanna Cord-on-Cord, Clemson Island/Levanna Cord-on-Cord: Punctated, and Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal. One vessel is an example of the Clemson Island/Carpenter Brook Cord-on-Cord: Corded Oblique type, which is also not very diagnostic of any particular time interval within the Clemson Island sequence. There are three examples of late Owasco types (MacNeish 1952) including one vessel each of Bainbridge Notched Lip, Clemson Island/Owasco Corded Horizontal, and Owasco Herringbone. Based on the presence of these vessels, the use of this portion of the site as a storage area dates closer to A.D. 1200 than A.D. 1000. The absence of any Shenks Ferry vessels suggests that the use of this section of the site does not post date A.D. 1200.

Table 26 shows the distribution of varied ceramic types within individual undisturbed features and lists all of the features that contained more than two vessels. Of the ceramic types present in these features, only one (Clemson Island/Owasco Corded Horizontal) is a later type dating closer to A.D. 1200 than A.D. 1000. As was the case for the total ceramic assemblage (Table 23), the non-diagnostic types (Clemson Island/Levanna Cord-on-Cord, Clemson Island/Levanna Cord-on-Cord: Punctated, Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal) are the most common, although the Clemson Island/Levanna Cord-on-Cord type is less common among these particular features than it is in the total ceramic assemblage. The most that can be said is that there are no anomalous ceramic associations within these features. However, given the fact that the most common ceramic types in these features are not particularly diagnostic of specific time intervals within the Clemson Island sequence, the absence of anomalous associations does not provide any additional information on the contextual integrity of these features.

FIGURE 65
Pipe Fragments



In reconstructing the vessels, crossmends of sherds from separate features were noted. No such cross-mends were identified for the vessels from Section 3 (Table 21) and only two were noted for Section 1 (Table 20). Two sherds from an Owasco Herringbone vessel in Features 205 and 198 crossmended. These two features are both located in the dense accumulation of storage features in the eastern portion of Section 1 (Figure 23) and probably represent an unintentional mixing rather than clear-cut evidence of the contemporaneity of the two features. Sherds from a Shenks Ferry vessel crossmended between Features 235 and 693. These features are located more than 50 m apart and Feature 235 contains Contact Period artifacts. This particular cross-mend is a result of post-depositional disturbance and clearly illustrates the degree of disturbance and mixing of materials that has occurred at the site.

A number of ceramic smoking pipe fragments were found at the West Water Street Site. Figure 65 shows four of the most interesting examples from the sample of 13 individual pipes. The pipe shown in Figure 65a is a mouthpiece section of a platform pipe. Platform pipes are usually manufactured from soft stones such as soapstone or chlorite; however, ceramic examples have

been found, such as the ceramic platform pipe found at the Middle/Late Woodland Hell Island Site in north central Delaware (Custer 1989:292). Platform pipes are usually found in Middle Woodland contexts predating A.D. 1000 (see discussion in Custer, Rosenberg, Mellin, and Washburn 1990:161-164); however, they could be present in early Clemson Island assemblages. In general, this particular pipe fragment probably dates to an early Clemson Island occupation of the site.

The pipe illustrated in Figure 65b is manufactured from a green chlorite and is a mouthpiece fragment of a pipe of uncertain bowl shape. The form of the mouthpiece is not at all typical of stone pipes and the pipe sherds' shape does not provide chronological information. However, this pipe does exhibit a variety of incised designs and some are quite similar to incised designs seen on a chlorite pipe fragments from the Island Field Site in central Delaware (Thomas and Warren 1970). The Island Field Pipe is dated to ca. A.D. 900 (Custer, Rosenberg, Mellin, and Washburn 1990:161-164) and it is suggested that design similarities place the chlorite pipe fragment from West Water Street into a similar time interval of an early Clemson Island occupation of the site predating A.D. 1000.

Figure 65c shows a ceramic pipe fragment that is very similar to Owasco types dating to ca. A.D. 1000 - 1200 (Ritchie 1969:295). The cord impressions on the bowl are quite similar to those seen on the ceramic vessels from the site even though they are executed with a much finer cord. The pipe shown in Figure 65d was found in a Clemson Island feature excavated during the Phase II excavations. A radiocarbon date of 850 ± 60 (Beta-53663 - A.D. 1100) was obtained from charcoal from the feature. This pipe is unlike any pipes found at any other sites.

To summarize the chronological information that can be gained from the analysis of the ceramic assemblage, it is unfortunate that the most commonly occurring ceramic types (Clemson Island/Levanna Cord-on-Cord, Clemson Island/Levanna Cord-on-Cord: Punctated, Clemson Island/Carpenter Brook Cord-on-Cord: Corded Horizontal) are not particularly diagnostic of any individual time intervals within the Clemson Island sequence. There is only one vessel and two pipe fragments from the early Clemson Island interval pre-dating A.D. 1000 indicating that most of the Clemson Island occupation post-dates A.D. 1000. The absence of the earlier Jack's Reef projectile points also supports this assertion. Numerous ceramic vessels dating closer to A.D. 1200 than A.D. 1000 are present at various locations throughout the site and their presence suggests that much of the Clemson Island occupation dates closer to A.D. 1200 than A.D. 1000. Distribution of ceramic types within individual features and sections of the site reveals little about the contextual integrity of the features.

<u>Radiocarbon Dates</u>. Radiocarbon dates are the final source of chronological information available for the Clemson Island component. Two radiocarbon samples were submitted for dating and

both were taken from Type I features. No samples from other feature types were submitted because of the previously noted problems with the context of features and the mixing of artifacts and ecofacts.

Organic materials were present in many of the Clemson Island features; however, the disturbed context of the features makes any dates from these features suspect. Given what we know about the disturbed feature context, we would be likely to dismiss any non-Late Woodland dates from these features. Even if dates that matched our intuitive sense of the age of the Clemson Island occupation were obtained, they too would be equally suspect due to the disturbed contexts. When contexts are disturbed, we cannot just accept dates we like and reject those we do not. No samples were available to date non-Type 1 features that contained only pre-Late Woodland artifacts. Therefore, radiocarbon dating could not be used to test the idea that these were disturbed Clemson Island features which included earlier artifacts as accidental inclusions in the pit fill.

The Type I "smudge pit" features were more likely to have an undisturbed context than other feature types, and a sample of charred corn cobs from Feature 131 was submitted to Beta Analytic, Inc. for dating. The date from the sample (Beta-63529) was modern. Taylor (1987:48) and Bender (1968; 1971) both note potential problems with dating non-woody plant materials, such as corn cobs, due to variable carbon isotope ratios. The sample from Feature 131 clearly shows that corn cob samples from West Water Street are subject to these problems and no additional samples were submitted.

Ceramic Artifact Analysis

The ceramic artifacts from the West Water Street Site were analyzed with regard to research questions other than those related to chronology discussed above. Individual vessels were used as the main source of data rather than sherds, where possible, because data based on vessel counts are more reliable than sherd counts (Rice 1987). The research issues discussed below include vessel size, vessels associated with Feature 55, smoothed-exterior vessels, vessel function, and textile impressions on vessels.

Vessel Size. Rim sherds were used to estimate the size of the ceramic vessels identified and listed in Tables 20 and 21. Rims were placed on a template of concentric circles of various sizes and vessel orifice size estimated. Vessel orifice size is not always an accurate indicator of vessel size because the everted shape of many Clemson Island vessel rims (Figure 61) would tend to over-estimate the vessel size. However, most Clemson Island vessels share this everted rim shape and all would be subject to the same over-estimation. Therefore, the measures discussed below are best viewed as relative measures of comparative vessel size rather than absolute measures.

TABLE 27
Vessel Size Data

Sample	Number	Mean (cm)	Standard Deviation (cm)
Section 3 - Undisturbed Features	10	25.6	8.1
Section 3 - Disturbed Features	18	24.4	5.9
Section 3 - All Features Combined	28	24.9	6.7
Section 1 - Storage Area	8	32.5	5.6
Section 1 - Undisturbed Features*	23	22.3	9.9
Section 1 - Disturbed Features*	27	22.7	5.6
Section 1 - All Features Combined*	50	22.7	7.6
All Features in Both Sections*	78	23.4	7.4

*- Does not include Storage Area of Section 1

FIGURE 66
Frequency Distribution - Vessel Size

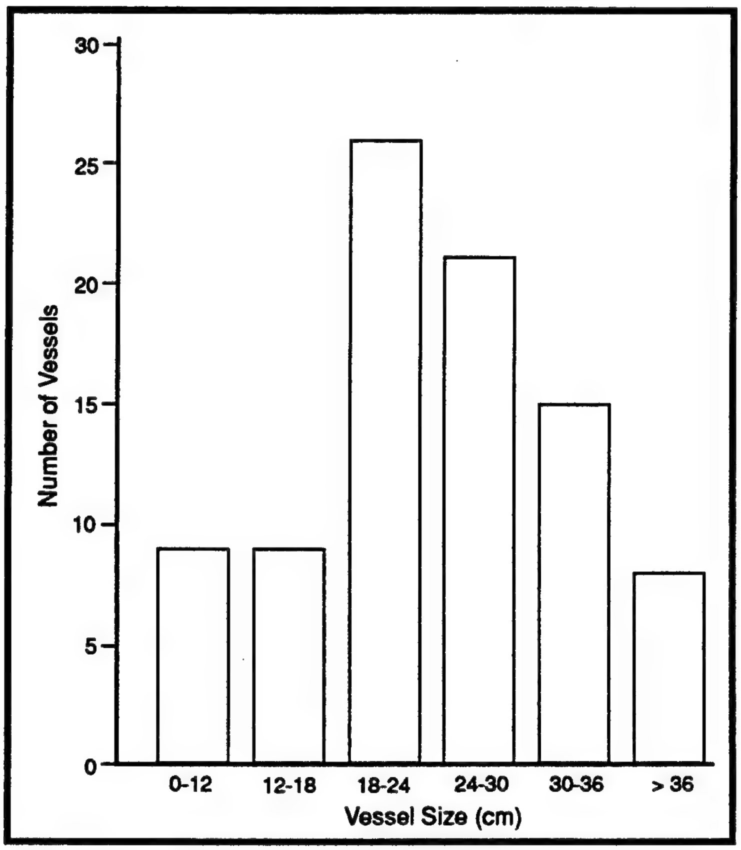


Table 27 lists the data on mean vessel sizes for a variety of samples from different areas of the site and the site as a whole. Figure 66 shows a frequency distribution of the vessel sizes for all vessels found at the site. The distribution shown in Figure 66 includes 78 vessels for which an orifice measurement was possible and is a normal distribution with a mean value of 23.4 cm (9.2") and a standard deviation of 7.4 cm (2.9"). Some

TABLE 28
Difference-of-Mean Test - Vessel Size from Storage Area Versus Other Samples

Comparison Sample	Test Statistic	Probability
Section 3 - Undisturbed	2.13	$p < .05$**
Section 3 - Disturbed	3.35	$p < .05$**
Section 3 - All Features	3.23	$p < .05$**
Section 1 - Undisturbed*	3.57	$p < .05$**
Section 1 - Disturbed*	4.34	$p < .05$**
Section 1 - All Features*	4.35	$p < .05$**
All Features*	4.23	$p < .05$**

* -Excludes Storage Area of Section 1
**-Statistically Significant Difference

very large vessels with orifice diameters larger than 36 cm (14") are also present as are very small vessels with orifice diameters less than 12 cm (4.5"). The mean and standard deviation figures show that nearly 70% of the vessels have an orifice opening between 30.8 cm (12.1") and 16 cm (6.3"). Using the typical vessel shapes illustrated in Figure 61 as a guide for estimating vessel height and applying the varied formulae available for estimating vessel volume (Rice 1987:219-226; Mounier 1987), 70% of the vessels would have a volume capacity between 30.0 liters (6.7 gallons) and 4.2 liters (.9 gallons).

Several studies (see Skibo 1992 and Rice 1987) have suggested that ceramic capacity is related to function. Larger vessels are believed to be associated more often with storage activities rather than processing and cooking activities, unless cooking and processing takes place on a communal basis by larger social units. Because the house data for Clemson Island societies indicate that very large communal social units did not exist, this assumption is probably valid for Clemson Island societies. In order to test this assumption, the mean size of vessels from the concentration of storage features in the eastern portion of Area 1 was compared to the sizes of vessels in other portions of the site. Table 28 shows the results of the application of a difference of mean test (Parsons 1974): comparing the mean value from the storage area with various other samples of vessels from the site. In all cases, the vessels from the storage area are larger than those of the other samples. The mean volume for all vessels from the site, exclusive of the storage area, is 12.5 liters (2.75 gallons) and the mean volume for the storage feature area is 35 liters (7.75 gallons). Thus, the vessels from the storage area have a capacity that is almost triple that of the general sample and the general assumption that larger vessels are associated with storage activities is not contradicted by the data.

It is also interesting to examine the values for the standard deviations in Table 27. With two exceptions, the measurements of vessels from the storage area show the lowest standard deviation value. A lower standard deviation indicates that the variability of the measurements is less and the low

value associated with the vessels from the storage area indicates that the vessels are not only larger, but they show less variation in size. The lower size variability fits well with the assumption of consistent use of the area for storage involving larger ceramic vessels. The large standard deviation values for the total ceramic assemblage reflects the fact that the sample reflects a variety of vessels used for a variety of purposes.

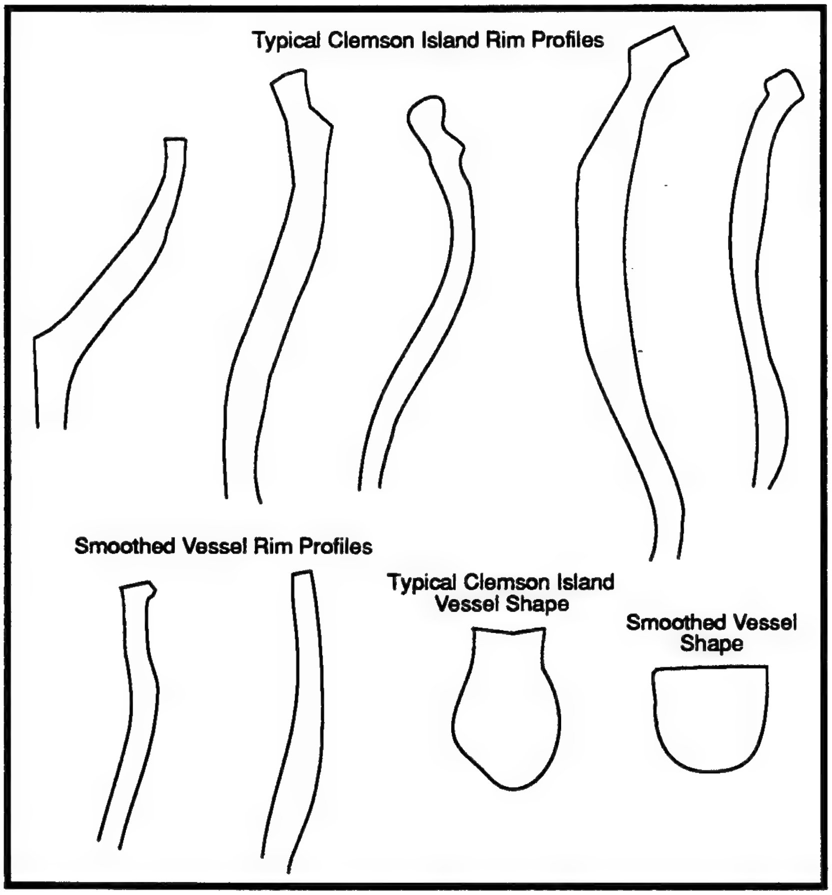
Vessels Associated with Feature 55. Feature 55 is a large platform hearth within a shallow pit that probably was used for cooking and processing (Figures 43-44). It is also possible that hot rock boiling took place in this area of the site. No ceramic rim sherds were recovered from this feature; however, a number of body sherds were found. Two different vessels can be tentatively identified on the basis of surface treatments, and the sherds are large enough to allow an estimate of their diameters at greater than 33 cm (13"). Applying the assumptions and formulae noted above, their volume capacity would be more than 36 liters (8 gallons) making them some of the largest vessels seen at the site.

Later in this section there will be a detailed analysis of the surface alterations of ceramic vessels and the links between these alterations and vessel functions. However, it can be noted here that both of the vessels associated with Feature 55 show significant amounts of sooting indicating that they were placed over fires (Hally 1983). The large size and surface alterations suggest that these pots were used for some kind of specialized resource processing activity that took place in the vicinity of this large feature. The large size of the vessels, compared to other processing vessels, further indicates that the resource processing that took place in this part of the site was different from the processing activities in other parts of the site.

Another interesting aspect of the ceramic sherds found in association with Feature 55 is the absence of rim sherds. Stewart (1988) has suggested that ceramic vessels were reused for different functions as pieces were broken from them. He notes that bases and non-rim body sherds were found more commonly at base camps and that rim sherds without body sherds seem to be found at other short-term processing sites. Similar patterns of ceramic discard have been observed at prehistoric sites in Delaware (Custer n.d.b). Stewart's explanation of this pattern is that vessels were carried around for varied resource processing activities. As breaks occurred on the more fragile rim sections, they were discarded at the locations of their use at smaller sites. The lower sections of vessels were then taken back to base camps and living sites where they were used for cooking pots, specialized resource processing, or even as scoops and ladles. The body sherds found in association with Feature 55 may have been part of a ceramic vessel used in that manner and the absence of rims in this particular setting seems to confirm Stewart's model of ceramic curation and use.

FIGURE 67

Smoothed Vessel Rim Profiles and Vessel Shape



Smoothed- Exterior Vessels. A series of eleven distinctive vessels with wiped, or smoothed, interiors and exteriors were identified during the analysis of individual vessels from the site. All eleven vessels were found in disturbed features from Section 3. Smoothed vessels are not common in Clemson Island ceramic assemblages and have not been specifically noted in other studies (e.g. - Hay, Hatch, and Sutton 1987; Stewart 1990).

An especially interesting feature of the smoothed vessels from the West Water Street Site is their rim profile shape. Figure 67 shows profiles of two smoothed vessel rim sherds in comparison to more typical Clemson Island rim profile shapes. In general, the smoothed vessels lack the constricted vessel "throat" beneath the top opening of the vessel and show no signs of everted, or flared, rims. Instead, they show rather straight sides. Figure 67 also shows the inferred vessel shape for these smoothed ceramics in contrast to the more typical Clemson Island shapes (see also Figure 61). The smoothed vessel shape is more like that of a straight-sided bowl in comparison to the "necked" shape of more typical Clemson Island vessels.

The context of these vessels does not reveal much about their function because all came from disturbed features. However, none were found in either the storage area in the eastern portion of Section 1 (Figure 23), within the stockade area in the eastern half of Section 3 (Figure 26), or in association with Feature 55. For the most part, these vessels were mixed among numerous features of various types within Section 3.

The different vessel shape of these smoothed vessels may be related to functional differences. The absence of a constricted neck on these vessels could have facilitated their use for processing activities such as hot rock boiling because it would be easier to get the rocks in and out of the vessels without the neck constriction. None of these vessels show signs of sooting on their exteriors indicating that they were rarely placed directly over fires (Hally 1983). This observation would be consistent with their use in hot rock boiling. The smoothed vessel interiors and exteriors may also be related to vessel function. Schiffer (1990) has suggested that the rough surfaces produced by cord impressions on many varieties of prehistoric ceramics played a role in heat retention when the clay vessel was placed directly over fires for cooking. If the smoothed vessels were indeed used for hot rock boiling, then heat retention would not be important and cord-marking would not be needed.

It is interesting to note that none of these vessels allegedly associated with hot rock boiling are associated with Feature 55, which may have been the location of such activities. The absence of these kinds of vessels from this location in the site undermines this interpretation of the use of Feature 55. However, it is possible that the use of Feature 55 for hot rock boiling did not involve the use of these specific types of vessels. Further research at other sites may identify similar kinds of vessels in better context and allow a more accurate assessment of their function.

<u>Surface Alteration and Vessel Function</u>. In the discussions of the vessels found in association with Feature 55 and the smoothed vessels it was noted that vessel surface alteration can be used to understand vessel function. This section applies the work of Hally (1993) and Skibo (1992) to a wider sample of ceramics from the West Water Street Site in order to better understand vessel function. The analysis again focused on vessels rather than sherds. This method limited the sample to a certain extent because most of the vessels were defined using rim sherds and most surface alterations related to function occur lower on the vessel. Nonetheless, in many cases body sherds associated with individual vessels could be identified and their surface alterations noted.

Hally (1983) and Skibo (1992) both list a variety of vessel alterations that can be linked to function and many are difficult to accurately identify. Both authors also note that the link between the vessel alterations and vessel function can be

somewhat tenuous. However, both agree that sooting, or blackening, of exterior vessel surfaces is a good indicator that the vessel was placed directly over a fire for heating. Presumably this heating was related to use of the vessel as a cooking pot. In contrast, vessels that were used for storage rarely show signs of sooting. It is possible that sooting could occur if broken sherds of a vessel were discarded in a fire and this factor could complicate the separation of storage and cooking vessels. However, in that case sooting would be present on the broken edges and interiors of the sherds. Therefore, sooting of exterior surfaces, but not interior surfaces or broken edges of sherds, is a reliable indicator that the pot was placed directly over a fire and used for cooking, or at least heating, some kind of food or other liquid.

Table 29 shows the counts of vessels showing sooting for a variety of samples from the West Water Street Site assemblage. These data suggest that the majority of the vessels show some kind of sooting and were used as cooking vessels. However, the vessels from the storage area show no signs of sooting. The sample from this area is small, only five vessels; nonetheless, absence of sooting on the vessels underscores the identification of this area as a specialized storage area.

The presence of sooting on vessels of varying size was also studied and Table 30 lists the numbers and percentages of vessels of various sizes with signs of sooting. Figure 68 shows the percentage of vessels with sooting plotted against vessel size. None of the smallest vessels show any signs of sooting and were probably never placed over fires. These small vessels with capacities of less than 2 liters (.4 gallons) are probably too small for effective use as cooking vessels and may have been personalized consumption or serving vessels. Sooting is most prevalent on vessels with capacities between 2 liters (.4 gallons) and 28 liters (6.1 gallons). These probably represent the main cooking vessels that were placed directly on fires. Vessels of these sizes probably were used by individual nuclear or small extended families. Vessels larger than 28 liters (6.1 gallons) show a much lower prevalence of sooting and these vessels were probably used as storage vessels. In sum, the data on sooting with respect to vessel size reinforces inferences about vessel function that were noted earlier in this report.

Textile Impressions. With the exception of the smoothed ceramic vessels described above, almost all of the Clemson Island ceramic sherds show signs of having had some type of corded textile pressed into them before they had dried. Numerous studies (e.g. - Maslowski 1984; Johnson and Speedy 1992) have examined these impressions to examine the textiles that were used to make them. Where fabrics and nets were used for the textile impressions, important data on textile manufacture can be gained. However, most Clemson Island vessels show signs of cord-wrapped stick or paddles having been used to make the impressions on the vessel surfaces.

TABLE 29
Ceramic Sooting Data

Sample	Number of Vessels	Number Sooted	Percent Sooted
Section 3 - Undisturbed	4	3	75
Section 3 - Disturbed	12	8	67
Section 3 - All Features	16	11	69
Section 1 - Storage Area	5	0	0
Section 1 - Undisturbed*	10	5	50
Section 1 - Disturbed*	12	8	67
Section 1 - All Features*	22	13	60
All Features - Both Sections*	38	24	63

* -Does not include Storage Area

TABLE 30
Vessel Size and Sooting Percentage

Vessel Size Category*	Number of Vessels	Number Sooted	Percent Sooted
0.2 liters (0-.4 gallons)	7	0	0
2-6 liters (.4-1.3 gallons)	5	3	60
6-14 liters (1.3-3.1 gallons)	19	12	63
14-28 liters (3.1-6.1 gallons)	10	5	50
28-48 liters (6.1-10.6 gallons)	10	2	20
> 48 liters (>10.8 gallons)	5	1	20

*Based on estimates from orifice size.

FIGURE 68
Sooting Percentages as a Function of Vessel Size

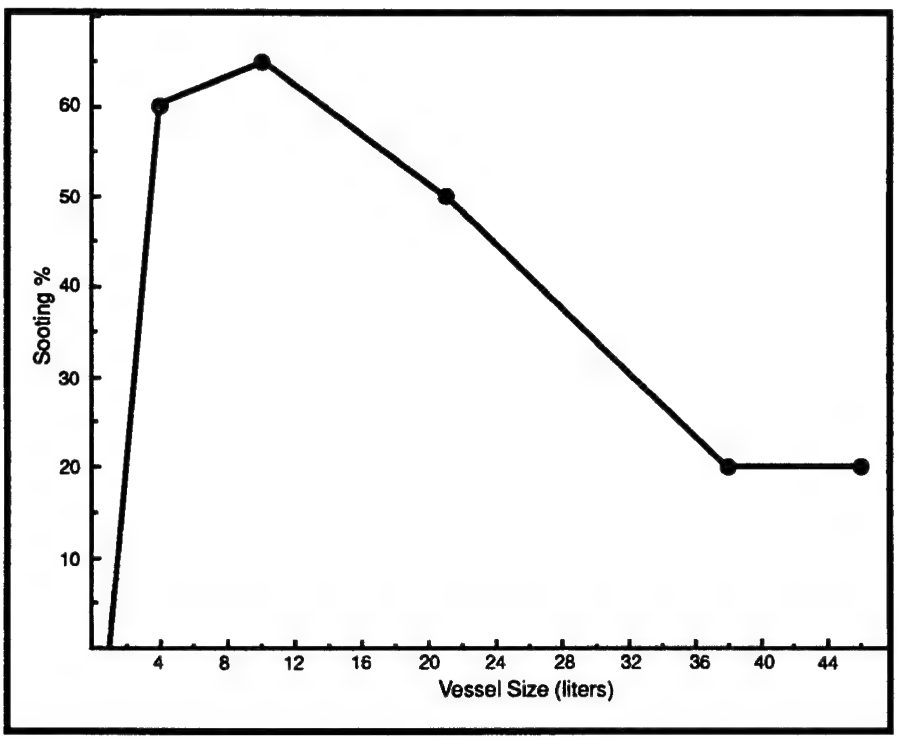


TABLE 31
Cordage Twist Data

Sample	Number	S-Twist	Z-Twist
Section 3 - Undisturbed	12	5 (42)	7 (58)
Section 3 - Disturbed	22	9 (41)	13 (59)
Section 3 - All Features Combined	34	14 (41)	20 (59)
Section 1 - Storage Area	12	7 (58)	5 (42)
Section 1 - Undisturbed Features*	19	10 (53)	9 (47)
Section 1 - Disturbed Features*	33	15 (45)	18 (54)
Section 1 - All Features Combined*	52	25 (48)	27 (52)
All Features in Both Sections*	86	39 (45)	47 (55)

*- Does not include Storage Area of Section 1

Recent research (Johnson and Speedy 1992) has shown that there may be important cultural implications for the directions of twists used to manufacture prehistoric cordage. In some cases, there seem to be links between cordage twist directions and ethnic group identification; however, such identifications can be problematic. In other cases, changes in cordage twist preferences have been related to technological changes (Hall 1980; Kelly 1984). In order to provide data for the examination of these research questions, cordage twist data were gathered from individual Clemson Island vessels. Table 31 lists the cordage twist data for various samples from the West Water Street Site.

The data in Table 31 shows a relatively even mix of twist directions for all samples. Little data on cordage twist have been published, and most of it is based on sherd counts rather than vessel counts. Therefore, there are no reliable samples in the local published literature to which the West Water Street Site data can be compared. The most that can be noted is that Clemson Island groups at this site seem to have no preferred twist directions in the cordage manufacturing techniques. As comparable data are gathered at other sites, further comparisons can be made.

Lithic Artifact Analysis

A large number of lithic artifacts, including projectile points, bifaces, flake tools, and debitage, were recovered from the Clemson Island features and from test units in the uppermost stratigraphic levels of the West Water Street Site. However, it is difficult to assess the cultural significance of these artifacts given the previously noted disturbed context of this portion of the site. If mixing of artifacts like broadspears occurred, as has been demonstrated, then smaller flake tools and debitage can be mixed as well. Therefore, the assemblage of lithic artifacts present in the Clemson Island features and test units are a mixed bag of artifacts representing numerous centuries and many different prehistoric societies.

TABLE 32
Projectile Points and Late Stage Bifaces - Clemson Island Component

Sample	Triangular Points		Bifaces (Late Stage)			
			Rejects		Discards	
	Chert	Jasper	Chert	Jasper	Chert	Jasper
Section 1						
Intact Features	5	0	5	1	16	1
Disturbed Features	18	0	27	2	28	0
Total	23	0	32	3	44	1
Section 3						
Intact Features	3	0	3	1	5	2
Disturbed Features	4	0	10	2	7	0
Total	7	0	13	3	12	2
Grand Totals	**30**	**0**	**45**	**6**	**56**	**3**

In spite of the mixing of the lithic artifacts, some descriptive data can be offered. For example, triangular points are diagnostic of the Clemson Island occupation and they are described below. Flake tools are also described, but they could date to any of the time periods between 2500 B.C. and A.D. 1200.

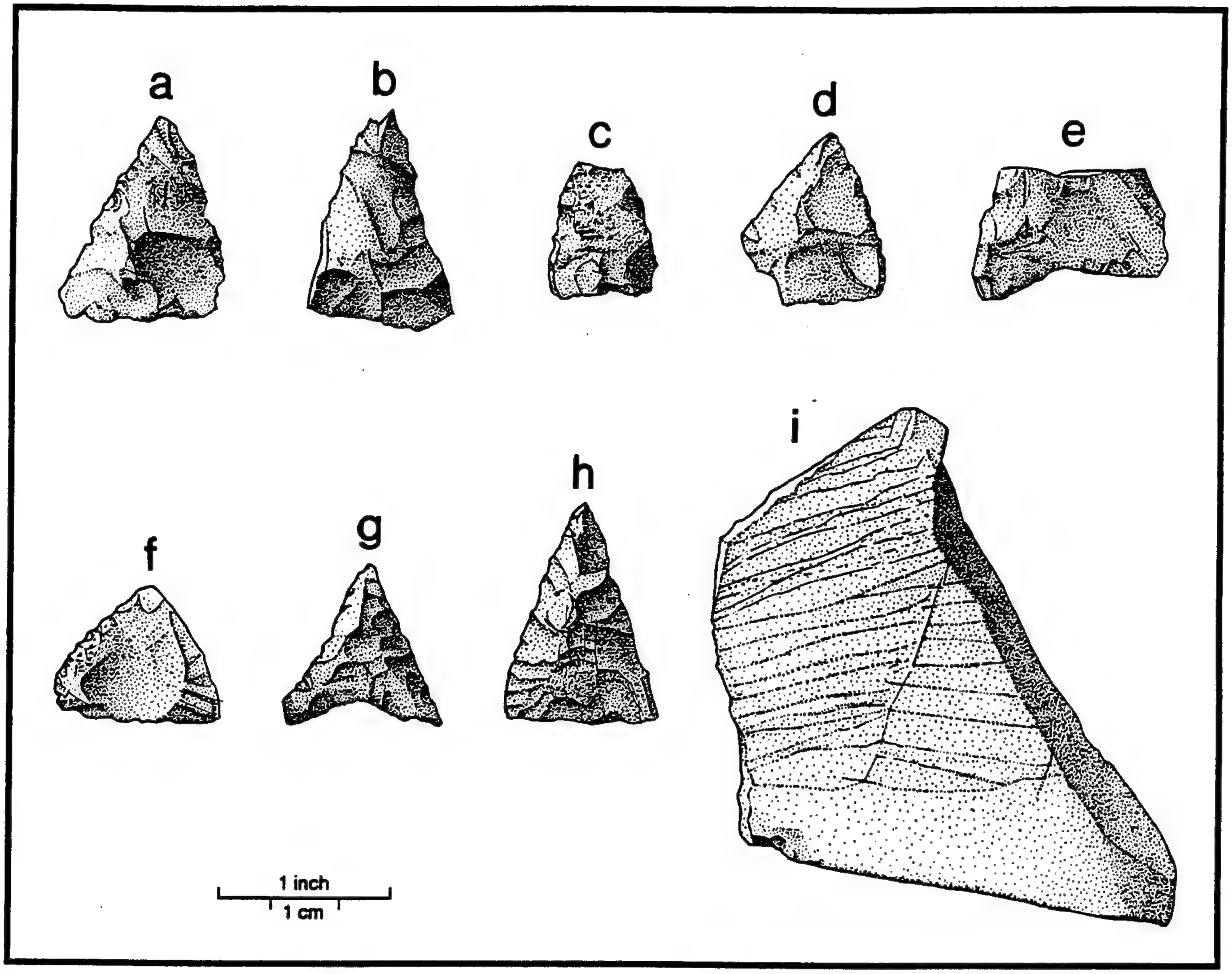
Triangular Projectile Points. A total of 36 triangular projectile points were recovered from the West Water Street Site. Four points were found during test unit excavation in Section 3. Thirty triangles were recovered from Clemson Island features, including five points from intact Clemson Island features and 18 points from disturbed Clemson Island features in Section 1. Three points from intact Clemson Island features and four points from disturbed Clemson Island features were found in Section 3 (Table 32). Two triangular projectile points were found in Contact Period features (one each in Features 81A and 531), but it is not clear whether these points originated in the Contact Period or in the earlier Clemson Island Period, since both features contained both Contact Period and Clemson Island artifacts.

All of the points were manufactured from chert and were further analyzed to determine whether they were rejected during manufacture or discarded after being used. Rejected points rarely show use wear and usually display a break due to manufacturing errors or flaws in the lithic raw material. Points may be rejected before breakage due to flaws such as an irreducible mass, or hump, on the biface. Discarded tools, which may be broken or fully intact, do show signs use wear, including damage in the form of an impact fracture, edge wear or resharpening wear, and shoulder damage. Discarded points were disposed of because the damage or wear which rendered them useless.

Six of the triangular points from the site were rejects. Four of the points were rejected due to an irreducible mass or hump (Figure 69a). One of these points showed use wear on one edge, indicating that it was used as a cutting/scraping tool

FIGURE 69

Triangular Points and Incised Stone



after it was rejected. Two of the points were rejected due to flaws in the material which caused fractures in the tools during manufacture. One of these rejects also showed edge wear indicating that it was later used as a cutting implement (Figure 69b).

Thirty triangular points were discards. The most common cause for discard was tip damage caused by impact fracture. Ten points, or 27% of the total sample, exhibited tip damage due to impact fracturing. Figure 69c shows an example of a triangular projectile point with tip damage. This type of damage indicates that these points were used as projectiles. Shoulder damage accompanied tip damage in five of these points. Shoulder damage is sometimes caused by the haft on impact and further supports the use of these points as projectiles (Custer et al. 1993). Three points, eight percent of the sample, showed only shoulder damage (Figure 69d).

Nine discards, 25% of the total sample, had transverse medial fractures (Figure 69e). This type of break is associated with prying and cutting motions employed in butchering activities (Ahler 1971: 84, 119-121). One of the points with a transverse medial fracture also had shoulder damage. Five points were discarded due to exhaustive resharpening. Two examples were resharpened so heavily that their lengths were only 75-80% of their widths. Figure 69f illustrates one of these points. Both of these points had convex lateral edges which were too thick to be sharpened further. The three additional heavily resharpened rejects had highly concave lateral edges (Figure 69g). In addition to these five points, ten triangles, including several with tip and shoulder damage and transverse medial breaks, showed evidence of resharpening. In these cases, however, the resharpening was not the reason for discard. The three final triangular points designated as discards showed signs of damage and almost no wear (Figure 69h). Only one of these points showed signs of slight resharpening. The reason for discard for these three points is unknown.

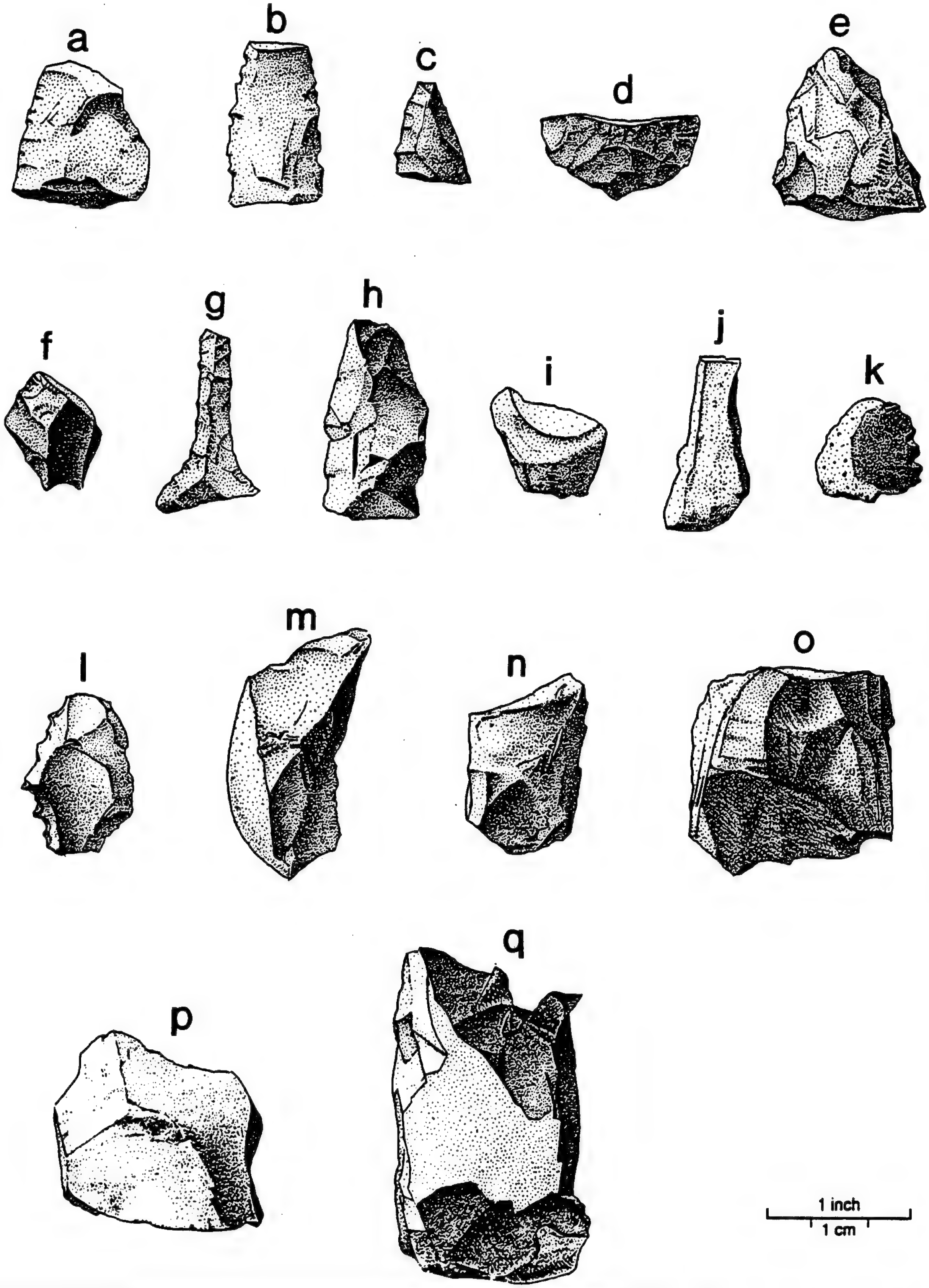
Bases of the triangular projectile points were either straight (59%) or concave (41%). Only three points exhibited cortex. Eight points (22% of the sample) were clearly made from flakes. A similar percentage of triangles produced from flakes was present at the Slackwater Site (36LA207), a Shenks Ferry village site (Custer et al. 1993:105). Binford (1979) suggests that the production of projectile points from flakes corresponds with the concept of expedient tool use where lithic resources are readily available.

Triangular projectile point dimensions varied greatly. On points without tip damage or transverse medial breakage, the length from base to tip ranged from 15.3 mm to 31.9 mm with a mean of 24.0 mm. On points without shoulder damage, the width of the base from shoulder to shoulder ranged from 14.5 mm to 29.2 mm, with a mean of 21.8 mm.

<u>Bifaces</u>. The biface category includes both early and late stage biface that do not possess hafting elements (Lowery and Custer 1990:86). Also included in this category are broken biface fragments which cannot be more specifically identified. Table 32 lists the totals of late stage biface rejects and discards and triangular projectile points found in Clemson Island features in Sections 1 and 3. A total of 112 bifaces and biface fragments were recovered from intact Clemson Island features. This total does not include the eight triangular projectile points from intact features, but does include ten late stage biface rejects, 24 late stage biface discards, 31 early stage biface rejects, and 47 biface fragments. Of all the bifaces and biface fragments, only 11 were manufactured from jasper. The remaining 90% were produced from chert. This ratio of jasper to chert bifaces closely resembles the ratio of jasper debitage to chert debitage encountered in the Clemson Island component.

FIGURE 70

Bifaces and Flake Tools - Clemson Island Component



Ten late stage biface rejects were recovered from intact features. Figure 70a illustrates an example of a late stage biface reject from the assemblage. Eight of these were distal fragments. The other two rejects were a lateral fragment and a medial fragment, respectively. Seven examples were broken during manufacture due to material flaws. The other three exhibited fractures that appeared to have been the results of manufacturing error during the resharpening process. One of the rejects was reworked after breakage into a bi-edged cutting implement.

Of the 24 late stage biface discards recovered from the Clemson Island features, 20 were distal fragments. Three medial fragments were identified among the sample (Figure 70b). One late stage discard was unbroken and seemed to have been abandoned when it could be resharpened no further. Eight of the distal fragments exhibited tip damage in the form of impact fractures (Figure 70c), indicating their use as projectiles. On one distal fragment, a large impact fracture was retouched to extend the life of the point. Another distal fragment had been retouched around its entire edge surfaces. This biface was probably discarded when it became too small to resharpen and use. Four distal fragments had snap fractures which are an indication of compression use. Nine discards exhibited transverse medial fracturing which can occur during cutting and prying motions employed in butchering activities (Ahler 1971:84 119-121).

Three additional discards were reworked into tools. One medial portion of a late stage biface had been retouched along its lateral edge into a bifacial cutting tool. This example had several deep step fractures on the cutting edge which is indicative of use on hard surfaces such as bone and most woods (Wilmsen 1970). Another discard, a distal fragment, also showed retouching and step fracturing. The final discard reworked into a tool had multiple functions (Figure 70d). Two surfaces had been reworked into a cutting tool. These showed scalar flaking and were polished. Also, a protrusion on the tool appeared to have the function of a graver. The wear patterns on the graver also matched those on the reworked cutting surfaces.

Thirty-one early stage bifaces were recovered from intact Clemson Island features. Table 33 lists the total number of early stage bifaces recovered from intact Clemson Island features. Figure 70e illustrates an example of an early stage biface from this assemblage. All the bifaces were rejects which were broken because of flaws in the material or were abandoned before breakage because of apparent material flaws, irreducible thickness, or fracture planes. Three early stage bifaces showed use wear patterns on their lateral edges which indicated their use as cutting or scraping implements.

Forty-seven biface fragments were recovered from intact Clemson Island features. Table 34 lists total biface fragments recovered from intact Clemson Island features. Nineteen biface fragments showed varying degrees of utilization and reworking (Figure 70f). Most of the utilized fragments were small (less

TABLE 33
Early Stage Biface Rejects - Clemson Island Component

Sample	Chert	Raw Materials Jasper	Other
Section 1			
Intact Features	23	3	0
Disturbed Features	5	2	1*
Total	28	5	1
Section 3			
Intact Features	4	1	0
Disturbed Features	5	1	2**
Total	9	2	2
Grand Total	**37**	**7**	**3**

***Siltstone**
****Both Argillite**

TABLE 34
Biface Fragments - Clemson Island Component

Sample	Raw Material			
	Chert	Jasper	Argillite	Siltstone
Section 1				
Intact	37	1	0	0
Disturbed	69	3	1	1
Total	106	4	1	1
Section 3				
Intact	8	1	0	0
Disturbed	20	1	0	0
Total	28	2	0	0
Grand Total	**134**	**6**	**1**	**1**

than 20 mm in length) and appeared to be used as expedient cutting tools. These tools display a variety of wear including scalar flaking and step fracturing which indicates use on several types of materials.

A total of 187 bifaces and biface fragments were recovered from disturbed Clemson Island features in Sections 1 and 3. These bifaces and fragments are listed in Tables 32-34. This total includes 41 late stage biface rejects, 35 late stage biface discards, 16 early biface rejects, and 95 biface fragments. This total does not include the 22 triangular projectile points recovered from disturbed features. Eleven bifaces and biface fragments were manufactured from jasper, three were produced from argillite, and two were made of siltstone. The remaining 171 were manufactured from chert. The chert bifaces and fragments constituted 91% of the total sample of disturbed features.

The assemblage of bifaces and biface fragments from disturbed Clemson Island features did not differ significantly from the biface assemblage from intact Clemson Island features. Similar types of damage were noted among the late stage biface discards. Reasons for biface rejections were the same from both assemblages. The percentage of bifaces and fragments with utilization wear was also basically the same for both intact and disturbed features.

<u>Drills</u>. Drills are defined as either unifacial or bifacial tools with a hafting element and a width/thickness ratio of less than 1.5 at their distal end (Lowery and Custer 1990:86). Three drills were recovered from intact Clemson Island features and all were bifacial. Table 35 lists drills found in intact Clemson Island features. Two of these drills had hafting elements (Figure 70g) and portions of the drill bit or shaft. Both were broken by compression which was indicated by the snap fractures at the distal ends of the fragments. The remaining drill fragment consisted only of a medial and distal drill portion. This fragment possessed no hafting element and appeared to have

TABLE 35
Flake Tools - Clemson Island Component

Sample	Side Scraper	End Scraper	Concave/Biconcave Scraper	Drill	Denticulate	Graver	Wedge	Slug-shaped Uniface
Section 1								
Intact	5	7	11	2	6	2	1	0
Disturbed	21	8	19	14	15	0	2	1
Total	26	15	30	16	21	2	3	1
Section 3								
Intact	2	2	0	1	1	0	0	0
Disturbed	1	1	3	0	4	0	0	0
Total	3	3	3	1	5	0	0	0
Grand Total	29	18	33	17	26	2	3	1

been broken in the late stage of manufacture. The fracture was clean and appeared to be the result of a manufacturing error. The tip of this drill fragment showed no wear or resharpening. Conversely, the drills with hafts showed signs of beveled resharpening, indicating previous use. All the drills from intact features were manufactured from chert.

Fourteen drills and drill fragments were recovered from disturbed Clemson Island features. Table 35 lists all the drills recovered form disturbed Clemson Island features. All drills were produced from chert. Eleven of the drills and drill fragments came from one feature: Feature 195. Six drills from this feature were proximal/medial fragments and three drill fragments were medial/distal fragments. Two drill fragments, a proximal fragment and a medial/distal fragment, mended. These fragments exhibited snap fracturing as a result of compression of the drill. Two other drill fragments also displayed snap fractures. Two drills from Feature 195 were made from flakes and may have also been used as awls. The shafts of these two examples were both bifacially worked, as were the shafts of the other drills. One medial/distal drill fragment was recovered from Feature 176. This drill also displayed a snap fracture. Beveled resharpening was noted on several drills in this assemblage. Two chert drill fragments were recovered from a burial feature (Feature 559) described later in this report. These fragments mended to each other and displayed compression fracturing.

Scrapers. Lowery and Custer (1990:89-90) define three types of scrapers: side, end, and concave/biconcave. All three types were present in the assemblage from intact Clemson Island features. All of the 27 scrapers except one were made of chert. The other was made of jasper. Table 35 lists the scrapers found in intact Clemson Island features.

Side scrapers are defined as flake tools retouched on their lateral surfaces, but not on their distal or proximal ends (Lowery and Custer 1990:89). Seven side scrapers were recovered from intact Clemson Island features. Figure 70h illustrates an example of a side scraper from an intact Clemson Island feature.

Wear patterns on the working edges of these scrapers ranged from smooth, hollow scalar flaking with polished edges, indicating use on a soft surface such as a hide, to rough, steep step flaking wear, which is indicative of use on a hard surface such as wood, bone, or antler (Wilmsen 1970). Two side scrapers showed multiple working edges.

Nine end scrapers were found in intact features (Figure 70i). End scrapers are defined as unifacial flake tools which are retouched on either their distal or proximal ends. These ends are their primary working edges although the lateral edges may be retouched to give the scraper a trianguloid shape (Lowery and Custer 1990:90). Three of the end scrapers were manufactured from core fragments and three were produced from flakes.

Eleven concave/biconcave scrapers were included in the assemblage from intact Clemson Island features. Concave/biconcave scrapers are often referred to as spoke shavers and are characterized by unifacial retouch along one or two lateral edges (Lowery and Custer 1990:89). Figure 70j illustrates an example of a concave/biconcave scraper from the intact assemblage. These scrapers were made concave through use and resharpening and several examples displayed multiple grooves worn into them. The concave/biconcave scrapers showed both scalar and step fracture wear, indicating use on a variety of hard and soft materials.

Fifty-two scrapers were recovered from disturbed Clemson Island features. This total includes 22 side scrapers, nine end scrapers, and 22 concave/biconcave scrapers. Table 35 lists the scrapers and other flake tools recovered from disturbed Clemson Island features. Three scrapers were produced from jasper, two were made from argillite, and one was made of siltstone. The remaining 46 were manufactured from chert. The scrapers from the disturbed feature assemblage showed the same wear patterns as the described for the scraper assemblage from the intact Clemson Island features.

<u>Denticulates</u>. Seven denticulates were recovered from intact Clemson Island features. Table 35 lists the denticulates recovered from Clemson Island features. Denticulates are defined as flake tools with serrated edges and may be either unifacially or bifacially retouched (Lowery and Custer 1990:93). Figure 70k depicts a unifacial denticulate from the intact assemblage. Five of the denticulates were unifacial and two were bifacially retouched. Three of the denticulates showed edge wear and retouching on multiple edges. The example illustrated in Figure 70l had one edge that was heavily and deeply serrated and the opposing edge was much less heavily flaked. In effect, this tool was multi-purpose with one edge used for rough cutting and the other edge used for lighter work. All the denticulates were made from flakes. Six were made of chert and one of siltstone.

Nineteen denticulates were recovered from disturbed Clemson Island features (Table 35). Seventeen of these tools were

produced from chert, and two were produced from jasper. Examples of these denticulates showed either bifacial or unifacial retouching. Eleven were made from flakes.

Gravers. Gravers are defined as unifacial tools which have one or more pointed projections are most often used for cutting grooves in antler or bone (Lowery and Custer 1990:92). Two gravers were found in intact Clemson Island features (Table 35). Figure 70m illustrates an example of a graver from this assemblage. This graver exhibited only one projection which was polished from use on a soft surface, perhaps a hide. The other example had two projections and multiple concave scraping edges surrounding the graver projections. Both gravers were made from chert cobble core fragments. No gravers were found in disturbed Clemson Island features.

Wedges. Wedges or "pieces esquillees" (Bardon and Bouyssonie 1906; Lothrop and Gramly 1982) are defined as bifacially retouched tools which have a flattened end which shows signs of battering and a thin end demonstrating bifacial retouch and wear (Lowery and Custer 1990:93). One chert wedge (Figure 70n) was found in an intact Clemson Island feature (Table 35). Wedges are believed to function as bone, antler, and woodworking tools (Lowery and Custer 1990:93).

Two chert wedges were recovered from disturbed Clemson Island features (Table 35). These tools were both bifacially retouched and showed evidence of battering on their flattened ends.

Slug-Shaped Unifaces. Although no slug-shaped unifaces were found in intact Clemson Island features, one was recovered from a disturbed Clemson Island feature (Table 35). Lowery and Custer (1990:90) used this term to describe tools with a slug-like shape, a length/width ratio of more than 3.00, one pointed end, and biconvex edges. The term "limace" is often applied to this tool type (Bordes 1961:23). Bordes, however, states that this type must have a continuous retouch to be a true "limace." The example from the disturbed Clemson Island feature had all the aforementioned attributes, but not the continuous retouch. The tool more closely resembles Lowery and Custer's type. This slug-shaped uniface was made off a flake.

Cores. Thirty-nine cores were recovered from intact Clemson Island features. Table 36 lists the cores found in intact Clemson Island features. This includes 16 regular cores, 15 bipolar cores, and eight cobble cores (Figure 70o-q). Two cores were made of jasper and were manufactured from primary material. The remainder of cores were chert with the majority manufactured from primary materials. Cores of all three types ranged in size from very large and unexhausted to very small and completely exhausted. Platform preparation was evident on a number of cores of each type. Cores were rejected or abandoned for several reasons including material flaws, size, exhaustion, and fracture planes.

TABLE 36
Cores - Clemson Island Component

Sample	Regular Core	Bipolar Core	Cobble Core
Section 1			
Intact	15	11	8
Disturbed	24	13	35
Total	39	24	43
Section 3			
Intact	1	4	0
Disturbed	1	7	5
Total	2	11	5
Grand Total	**41**	**35**	**48**

TABLE 37
Debitage - Clemson Island Component

Raw Material	Section 1	Section 3	Total
Quartzite	211	479	**690**
Quartz	31	43	**74**
Chert	20,673	12,426	**33,099**
Jasper	1,590	1,025	**2,615**
Rhyolite	4,118	1,553	**5,671**
Argillite	310	281	**591**
Ironstone	2	16	**18**
Other	134	290	**424**
Total	**27,069**	**16,113**	**43,182**

Table 36 lists the 85 cores found in disturbed Clemson Island features. The predominant type of core was the cobble core. Forty cobble cores were included in the disturbed feature assemblage. Twenty-five regular cores and 20 bipolar cores were also included. Eighty (94%) of the cores were of chert, and five were made of jasper. Fourteen of the cores showed signs of utilization apart from their functions as cores. This utilization was in the form of both scalar and step flaking wear, indicating their expedient use as cutting or scraping implements.

Pitted Anvil Stones. A total of 34 pitted anvil stones were recovered from intact Clemson Island features. Of the 34 anvils, 16 were pitted on only one face (unipitted) and 18 displayed pitting on both faces (bipitted).

The anvil stones were almost exclusively river-washed cobbles of sandstone and siltstone. The cobbles were rounded, oval, and irregularly shaped. One anvil was produced from a large piece of quarried shale. All anvils had broad, flattened surfaces. Pitting was located only on these flat surfaces of the anvils. The pits on the anvils were usually circular and appeared as rounded depressions. The pits measured generally from 20 to 30 mm in diameter on the smaller anvils to 35 to 50 mm in diameter on the larger anvils. The depth of the pits ranged from approximately 1 mm in length/diameter to 10 mm. The length/diameter of the anvils ranged from 75 mm to 230 mm, with an average length/diameter of approximately 130 mm. Anvils weighed from 150 to 7700 g, with an average weight of approximately 800 g.

The pitted areas of the anvil stones were rough and uneven. The pitting appeared to be the result of repeated heavy blows characteristic of bipolar core reduction activities. It is believed that these stones were used as anvils during the bipolar reduction process. Bipolar core reduction was being employed by the inhabitants of the site during Clemson Island period as evidenced by the large numbers of bipolar cores and debitage recovered from Clemson Island features. Anvils, such as the ones described, are a necessary tool in the bipolar reduction process.

Aside from their use as anvils, 15 anvil stones were also used as hammers. This number includes five unipitted and nine bipitted anvils. The hammer components on these anvils was

indicated by battered, rough edges. Several anvils had hammer wear on more than one edge.

One unipitted anvil stone, also used as a hammer, had a third function. This function was that of a mortar. The stone appeared to have first been used as an anvil, then the pitted area was drilled or ground out and the orifice was used as a mortar. This was indicated by the smoothed surfaces of the mortar orifice. The depth of the orifice was 18.5 mm and its diameter was approximately 29 mm.

Thirty-eight pitted anvil stones were recovered from disturbed Clemson Island features. This total included 11 unipitted stones and 27 bipitted anvils. As with the anvils from the intact features, these anvils were made from river cobbles of siltstone and sandstone. Several were made of schist cobbles as well. The anvils had a similar size and weight range as those from intact features. Again, the pit appeared to be most likely the result of bipolar core reduction.

Twenty-five anvils, approximately 65% of the disturbed sample, also exhibited hammerstone wear patterns on their edges. This observation reinforces their multi-purpose function. One anvil was also used as an abrader, and one appeared to have been drilled or was the platform on which drilling was performed.

<u>Hammerstones</u>. Twelve hammerstones were recovered from intact Clemson Island features. These tools, like the anvil stones, were utilized river cobbles of dense sandstone or siltstone. Hammerstones ranged in shape from round to oval. Sizes ranged from 60 mm in length/diameter to 150 mm in length/diameter. Hammerstone weights varied from approximately 50 g to 1100 g, with an average of 230 g.

Nineteen hammerstones, were recovered from disturbed Clemson Island features. These, again, were utilized river cobbles of sandstone or siltstone. Size and weight ranges similar to those of the intact feature hammerstones were noted among the hammerstones from disturbed features. Also, similar wear patterns were observed.

<u>Netsinkers</u>. Two netsinkers were recovered from an intact Clemson Island feature. One netsinker was made from a flat, siltstone river cobble. The only flaking on the netsinker was on two opposing edges. This work took the form of unifacial notches, one on one side and three on the other side. Although it is not characteristic of netsinkers to have this many notches (one per side is common), the stone was undoubtedly a netsinker. The stone measured 80 mm by 40 mm and was 11 mm thick. The netsinker weighed 85 g. The other netsinker was a rounded, oblong cobble with bifacial notches on each end. This netsinker measured 110 mm long by 50 mm wide and weighed 120 g.

Five netsinkers were found in disturbed Clemson Island features. All five were produced from river cobbles of

sandstone or siltstone. All five netsinkers had two opposing notches, one on either side. The notches were the only intentional workings done on the netsinkers and they were not reshaped in any other manner. The netsinkers ranged in weight from approximately 130 g to 1250 g. Three of these netsinkers were much larger and heavier than the one found in an intact Clemson Island feature.

Miscellaneous Ground Stone Tools. One very large and heavy (over ten kilos) grinding stone was found in a disturbed Clemson Island feature. This stone was an irregularly shaped, flat river cobble with a large, shallow ground surface on both of its flat sides. The ground surfaces were large (over 120 mm long and 100 mm wide). The grinding stone also appeared to have been used as a bipitted anvil. Two small, circular pitted areas, one on each side, were noted. It is not unrealistic to imagine that this stone served several functions.

An additional lithic artifact of interest is shown in Figure 69i. It is a flat piece of sandstone that has a series of incised lines on it. No design is apparent, and it is impossible to assess the artifact's function.

Debitage. Table 37 lists the debitage recovered from features and test units in the upper stratigraphic unit at the West Water Street Site. This debitage assemblage represents several occupations spanning thousands of years and this mixing of artifacts precludes extensive analysis. Table 37 clearly shows that chert is the major lithic raw material used and comprises 76% of the assemblage.

Conclusions. The analysis of these lithic artifacts is hampered by their disturbed context. The range of tool types is quite broad, as would be expected at base camps, hamlets, or other habitation sites. The triangular projectile points and bifaces show expedient uses for a variety of functions and the ratio of tools to debitage is rather low (1:80). These observations imply that most of the lithic assemblage was not highly curated and conditioned by expedient use. Locally available cherts, many derived from river cobbles, are the main raw materials used and the focus on these local materials is also consistent with an expedient lithic technology.

Ecofact Analysis

The following section of the report describes the analysis of the faunal and floral remains recovered from regular screening and flotation of soils in the Clemson Island stratigraphic unit of the West Water Street Site. As was the case with artifacts recovered from these mixed deposits, the mixed and disturbed context of the ecofacts limits the range of analyses that can be undertaken with them. In fact, the disturbed contexts are even more critical for the ecofacts because if post-depositional disturbances can move large projectile points such as broadspears into Clemson Island features, these same processes can certainly

TABLE 38
Faunal Remains -
Phase II Excavations

Unidentified Mammal	Sucker
Bison	Chub/Minnow
Bear	Turtle
Deer	Snake
Elk	Bull Frog
Beaver	Leopard Frog
Squirrel	Toad
Unidentified Fish	Swan

TABLE 39
Faunal Remains - Phase III Excavations

Species	Number of Features with Species Present
Unidentified Bird	2
Unidentified Mammal	20
Bear	1
Chipmunk	1
Deer	11
Elk	3
Fox	2
Mountain Lion	1
Rabbit	1
Squirrel	2
Frog	2
Snake	1
Turtle	4
Unidentified Fish	3
Catfish	1

affect small bone fragments, seeds, and other ecofacts. Nonetheless, a consideration of ecofacts can still yield some information on Clemson Island lifeways.

Faunal Remains. Phase II excavations at the Water Street Site involved the excavation of a single Clemson Island feature (Feature 3) which contained very rich faunal remains (Table 38). The range of species represented and the large number of bone remains in the feature led us to expect that abundant faunal remains would be found in the features to be excavated during the Phase III study. Unfortunately, these expectations were not fulfilled. Feature 3 turned out to be an isolated occurrence with few other features located in adjacent areas (Figure 25), and faunal remains were rare within the other excavated features.

Table 39 lists the species represented in the sample of bones recovered and notes the number of features which contained the different species. Faunal remains were recovered from only 24 different features. Almost all of the remains were fragmentary and a large number could not be identified as to species. It is interesting to note that the range of species present in Feature 3 is almost as large as the range represented by the entire sample of features excavated during the Phase III excavations.

The range of species present is similar to that noted for other Late Woodland sites in the Susquehanna Valley (e.g. - Guilday, Parmalee, and Tanner 1962; Webster 1984). Deer comprise the largest proportion of the sample along with elk and probably represented the main meat source. Fish, including sucker and catfish, are also present and were a potential important food source. The presence of the fish remains may also be related to the presence of the large hearth feature (Feature 55). The frogs and toads in the features may not be food sources. Their

presence may be the result of accidental inclusion in pit fill when the creatures fell into the open pits.

The range of species also indicates that the riverine and adjacent uplands were all part of the catchment zone of Clemson Island groups living at the West Water Street Site. If the range of species is used as the basis for an "empirical determinant" of the site's catchment zone (Flannery 1976), then that catchment could be as small as a 3 km radius in order to include the riverine zone and adjacent uplands. This empirical figure compares well with the 5 km radius zone suggested by Hassan (1981) for agricultural societies.

It is interesting to note that most of the bones, especially the larger deer and elk bones, were fragmentary and charred. The fact that they were charred after breakage implies that the bones were broken by the prehistoric inhabitants of the site as part of the food consumption process. In the case of long bone fragments the breakage may be related to extraction of marrow. For smaller bones, the breakage may be related to extraction of collagen (Brennan 1981). Ethnographic and ethnohistoric data on traditional foodways of Native Americans of the Eastern Woodlands note that diets included a large number of stews, soups, gruels, and hominies (e.g. - Parker 1968). In many cases, meat and bone scraps and cleaned, but complete, fish and small mammals were added to the cooking pots to enrich these foods. Analyses of butchering marks on larger bone assemblages (e.g. Guilday, Parmalee, and Tanner 1962) support these contentions. The bone assemblage from the West Water Street Site seems to indicate that this kind of food preparation and diet extended back into Clemson Island times as early as A.D. 1000.

Floral Remains. Extensive analysis of floral remains from Clemson Island features was not undertaken because of the disturbed nature of the Clemson Island component. However, some preliminary studies were completed.

Table 40 lists the floral species recovered from Type I features. These features are the corn-cob filled "smudge pit" features and have the best context of any of the Clemson Island features. Therefore, this list of plant species represents the best data on the variety of plant food resources used by Clemson Island groups at the West Water Street Site. Domesticated plants (corn - *Zea mays*, beans - *Phaseolus vulgaris*) and wild plant foods are both present and suggest that Clemson Island diets contained a mix of wild and domesticated species. It is important to note that except for corn, the remaining plant species are represented by fewer than 9 seeds each. Therefore, the sample is rather small and should be viewed as preliminary data only.

The corn cobs present in these features are all of the 12 and 14 row varieties of Northern Flint, as would be expected for the time period between A.D. 1000 and A.D. 1200 (Cutler 1965; Yarnell 1976; Smith 1992). The absence of the more primitive

TABLE 40
Floral Remains from Type I Features

Corn	*Zea mays*
Wild Grape	*Vitis riparia*
Raspberry	*Rubus occidentalis*
Knotgrass	*Paspalum distichum*
Sumac	*Rhus glabra*
Butterfly Pea	*Centrosema virginainum*
Bean	*Phaseolus vullaris*
Peavine	*Lathyrus maritimus*
Smartweed	*Polygonum pensylvanicum*

TABLE 41
Floral Remains from Clemson Island Features

Raspberry	*Rubus occidentalis*
Blueberry	*Vaccinium vaccilans*
Pondweed	*Potamogeton natans*
Elderberry	*Sambucus canadensis*
Wild Grape	*Vitus riparia*
Corn	*Zea mays*
Black Locust	*Robinia pseudo-acacia*
Knot Grass	*Paspalum distichum*
Dock	*Rumey crispus*
Butterfly Pea	*Centrosema virginianum*
Lupine	*Lipinus perennis and albifrons*
Snowberry	*Symphoricarpos occidentalis*
Widgeon Grass	*Rupia maritima*
Mustard	*Brassica nigra*
Goosefoot/Lambs Quarter	*Chenopodium album*
Needlegrass	*Stipa viridula*
Pigweed	*Amaranthus blitiods, retroflexus and hybridus*
Timothy	*Phleum pratense*
Peavine	*Lathyrus maritimus*
Ground Cherry	*Physalis heterophylla*
Thimbleberry	*Rubus odoratus*
Sage	*Salvia lyrata*
Spurge	*Euphorbia maculata and corollata*
Sumac	*Rhus glabra*
Blackberry	*Rubus allegheniensis*
Copperleaf	*Acalypha gracilens*

varieties which have not generally been found east of the Ohio Valley (Adovasio and Johnson 1981; Smith 1992) confirms the notion that the Clemson Island occupation post-dates A.D. 1000.

Table 41 lists the plant remains found in features other than Type I varieties. This list contains a wider range of species than Table 40; however, the context of the specimens listed in Table 41 is more tenuous. The range of species is comparable to that seen at other Late Woodland sites (Moeller 1975a, 1975b; Ameringer 1975; Ritchie 1969;279-280). Included in Table 41 are wild seed plants such as goosefoot/lambs quarter (Chenopodium sp.) and pigweed (Amaranthus sp.). These species have been shown to be important wild food sources for Clemson Island groups (Baker 1980), and other Late Woodland societies of the Middle Atlantic region. Numerous other wild food species are also present.

In sum, the floral assemblage from the West Water Street Site includes a variety of wild and domesticated food species, medicinal species, and species whose use is uncertain. The main domesticants are corn and beans; however, squash and gourds (Curcurbits) are missing. The plant food diet of Clemson Island groups obviously contained a variety of wild and domesticated species. However, there is no way to assess the relative importance of these plant foods given the context of the Clemson Island features at the West Water Street Site.

FIGURE 71

Feature 559 Plan View and Profile

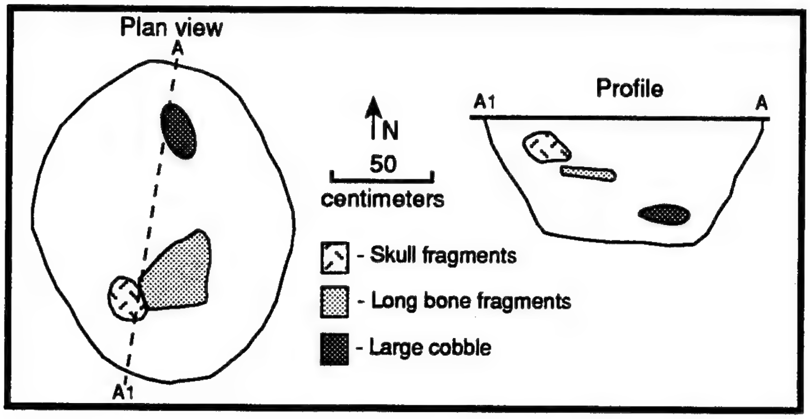


TABLE 42

Artifact Catalog - Feature 559

Debitage	953
Utilized flakes	73
Flake tools	4
Biface fragments	2
Cores	4
Hammerstones	1
Net weight	1
Anvil stones	5
Fire-Cracked rock	118 fragments (8453 grams)
Body sherds	262

Burial Description and Analysis

One human burial dating to the Clemson Island occupation of the site was encountered during the excavation of the West Water Street Site (Feature 559 - middle portion of Section 1, Figure 24). The excavation of the human remains followed the guidelines developed as a part of the scope-of-work for the project. These guidelines and procedures were described earlier in this report.

Figure 71 shows a plan view and profile of the feature, which shows no overt signs of post-depositional disturbance. In addition to the human remains, a large number of artifacts were present (Table 42). The range of artifacts is typical of other processing/refuse features at the site and it is definitely not a specialized burial feature. The feature also contains a large amount of fire-cracked rock and may have functioned as an earth oven or roasting pit before it was used for refuse disposal.

The human remains in the feature were very poorly preserved and consisted of skull fragments which directly overlay a series of fragmented long bones including two cervical vertebrae, a humerus, a clavicle, a tibia, and a femur. The long bones were in a stack under the skull and the burial is clearly

disarticulated. The disarticulated and incomplete nature of the human remains clearly show that this burial is a redeposited, secondary burial. The body was disarticulated before it was placed in the ground and was probably incomplete at the time of burial.

Most of the cranium was present, except for the maxilla and zygomatics, but was highly fragmented and deteriorated. The cranium had collapsed prior to excavation. The frontal was broken and only the superciliary arches and part of the nasal bones were intact. Both the frontal and circum-orbital regions were preserved. The occipital was partially intact with the external occipital protuberance complete. The foramen magnum and surrounding portions of the occipital were not present. Both parietals were completely collapsed and fragments had fallen into the cranial vault. Three complete molar crowns (LM1, LM2, LM3), as well as enamel fragments that could not be identified, were recovered from the maxillary region. A small portion of the left ascending ramus was also recovered but no alveolar portion was well preserved. No other portions of the mandible were present. All cranial fragments were too deteriorated to show any pathologies.

For the most part, all of the bones were all too deteriorated to show any signs of pathologies. However, one cervical vertebra showed lipping and antemortum deterioration of the centrum. This deterioration could be associated with the beginnings of arthritis (Mann and Murphy 1990). One of the three molar crowns (RM2) was worn to the dentin and the cusps of the other two molars were polished and worn, but no dentin was exposed. No caries were visible. This kind of tooth wear is typical of prehistoric Native American populations.

The fragmentary nature of the skeletal remains make it difficult to determine the sex of the individual. The mastoid processes are small and the nochal region is quite gracile. In addition, the supraciliary arches are extremely small. The remains are consistent with the suggestion that the skeleton is female, although a definite diagnosis of sex is not possible. Age determination was also difficult. The pathology of the vertebra, the tooth wear, and the fact that the temporal and lamdoidal sutures were not obliterated, but are closed, suggest that the individual was fully adult. However, this age estimate is tentative.

In sum, this burial is a secondary burial, perhaps a bundle burial. The body probably had been buried elsewhere, was exhumed - and not all pieces recovered, and then was placed in a feature that had been first used as an earth oven or roasting pit, and was then reused as a trash pit. Secondary bundle burials are known from other similarly dated sites in numerous parts of the Middle Atlantic (e.g. - Custer, Rosenberg, Mellin, and Washburn 1990: Ritchie 1969:261-266). Jones (1931) notes the presence of these kinds of burials at the Book and Clemson Island Mounds and Stewart (1990:95-96) notes variable burial treatment at Clemson

Island sites. Burials within trash pits are also documented for prehistoric Native American sites in the Susquehanna Valley and suggest a rather casual treatment of the dead.

Several authors (e.g. - Thomas 1970) have suggested that the reburial of disarticulated human remains is part of a rather elaborate burial program linked within a proscribed ritual system. Some ethnohistoric data (Zeisberger 1910) also suggest that various Native American groups exhumed recently buried bodies and took them with them when they moved from site to site. Other authors (Custer, Rosenberg, Mellin, and Washburn 1990) have suggested that secondary burials also reflect simple expediency. We will probably never know the circumstances of the secondary burial found at the West Water Street Site.

Discussion

Excavations of the Clemson Island component at the West Water Street Site identified a large number of pit features and recovered many artifacts and ecofacts. However, the context of these features, artifacts, and ecofacts was seen to be compromised by the fact that many of the features cross-cut one another and that in many cases artifacts from older time periods were present in the features. As was noted in the discussion of the site stratigraphy, the land surface upon which Clemson Island groups lived, discarded artifacts, and dug pit features had been stable for thousands of years. Numerous older cultures had lived in this location and deposited many artifacts on this same land surface. These older artifacts became mixed with Clemson Island artifacts, and artifacts from numerous Clemson Island occupations were mixed with one another in the features' fill. Therefore, the artifacts recovered from the features, and from the soils overlying the features, were a complicated mix of artifacts from many different time periods. This mix of artifacts clearly made analysis difficult. Nevertheless, insights concerning Clemson Island lifeways were gained.

The study of Clemson Island settlement patterns was an important component of the research design and these settlement patterns can be studied at the three main levels of analysis noted by Willey (1953): household, community, and region. A discussion of insights for each level are discussed below.

One clear-cut example of a Clemson Island house was encountered (Figure 55) and it was large enough to have accommodated a pair of nuclear families or a small extended family. The house probably dates to the later portion of the Clemson Island time period ca. A.D. 1200 and is larger than many other examples of Clemson Island houses. In an analysis of Owasco houses from this same general time period, Ritchie and Funk (1973:231-233) suggest that the size of houses increased through time and that house shape changed from a roughly square or circular shape to elongated rectangular longhouses. Trigger (1981) has suggested that the larger houses were needed as larger corporate matrilinear extended families became the basic unit of

food production and consumption. The Clemson Island house from West Water Street Site may be a sign that similar trends were occurring for Clemson Island cultures. However, because no known examples of Clemson Island longhouses are present in the archaeological record, it is possible that the process of development of matrilineages was not as advanced in Clemson Island cultures as it was in Owasco cultures. However, by the time that Stewart Phase Shenks Ferry cultures occupied the West Branch of the Susquehanna Valley (ca. A.D. 1200 - 1500), some larger longhouse-like structures were present (e.g. - Hart 1993b; Turnbaugh 1977:217; Stewart 1990:93; Bressler 1980) and matrilineal extended families had probably developed.

The Clemson Island house at the West Water Street Site is associated with numerous other features and this association forms a "household cluster" (Winter 1976). The household clusters include hearths and roasting pits, smudge pits associated with hide working, and generalized work areas that include evidence of flint knapping and stone tool production. These clusters indicate that resource processing and consumption and refuse disposal was localized in the individual households. However, storage seems to have been focused in specialized areas not associated with the houses within the community. Drennan (1976) has suggested that one step in the development of village organizations, and more complex social organizations, is the separation of activities from individual households and placement of them in a communal setting. Thus, the removal of storage from households in later Clemson Island communities like the West Water Street Site may be a sign of increasingly complex social organizations and more carefully organized village communities.

The mix of features and their disturbed contexts makes it difficult to understand community organizations at the West Water Street Site. Most of the site (Figures 23-27) shows a mix of feature types from various occupations and only a portion of any given occupation is present. These occupations were probably small hamlets or farmsteads, but little more can be said about them.

In two locations, however, the arrangement of features does reveal something of Clemson Island community patterns. A section of a stockade line was identified in association with the house pattern noted above. The stockade line could not be traced outside the project limits and it is unclear just how big an area it may have enclosed. Ground disturbance associated with a modern house and a historic sawmill also truncated the community associated with the stockade. Based on comparisons with other Clemson Island sites, the most likely possibility is that the stockade line encompasses a small hamlet with fewer than 10 houses within it. It is also possible that the Clemson Island community could have been much larger; however, this possibility is less likely because no larger Clemson Island communities have ever been identified. Answers to the question, "Just how big were the biggest Clemson Island communities?" will have to await

excavations at other sites. Nonetheless, the West Water Street Site excavations raise the possibility that very large Clemson Island communities may indeed have been present.

With regard to regional settlement pattern issues, it is interesting to consider the fact that the vast majority of the Late Woodland occupation at the West Water Street Site dates to the Clemson Island period between A.D. 1000 and A.D. 1200. Earlier Clemson Island occupations of the Middle to Late Woodland transition period and later Stewart Phase Shenks Ferry, McFate, and Susquehannock occupations are either completely missing or are represented by only ephemeral archaeological remains. It is possible that these occupations are present at the site outside of the excavation areas, but it is hard to imagine that additional signs of more substantial occupations from these cultures would have been absent from the excavation area. Therefore, it is more likely the case that occupations from these time periods are missing from the West Water Street Site and the Late Woodland occupation is limited to the time period between A.D. 1000 and A.D. 1200.

In contrast to the limited range of Late Woodland occupations present at the West Water Street Site, a wider range of Late Woodland occupations were present at the nearby Memorial Park Site, which is located at the confluence of the West Branch of the Susquehanna River and Bald Eagle Creek (Hart 1993b). The Late Woodland occupations at the Memorial Park Site may have some relation to the timing of the Clemson Island occupation of the West Water Street Site. The environmental setting of the Memorial Park Site at a major stream confluence was probably a more desirable settlement location for prehistoric groups. Especially during Late Woodland times, the wide expanse of floodplain at the mouth of Bald Eagle Creek would have provided lots of room for semi-sedentary communities and an expanse of arable land for horticulture.

The archaeological data from the Memorial Park Site clearly show that Clemson Island communities, probably in the form of hamlets and farmsteads, were present at the Memorial Park Site as early as A.D. 700. Numerous studies from throughout the Middle Atlantic region (e.g. - Turner 1978; Potter 1993) indicate that populations grew through the Middle and Late Woodland Periods. If population growth occurred among the Clemson Island communities at the Memorial Park Site, then it is possible that there was not room for all Clemson Island groups to live in the vicinity of the mouth of Bald Eagle Creek. Some Clemson Island groups may have had to settle in other nearby locations, such as the West Water Street Site. In this scenario, the Clemson Island occupation of the West Water Street Site could have been an "overflow" from the Memorial Park Site.

A substantial occupation post-dating A.D. 1200 is also present at the Memorial Park Site and seems to be organized quite differently from the earlier Clemson Island occupation. A large longhouse structure is present and the settlement is more

concentrated. Other more concentrated settlements from this time period are also known from the nearby region (Bull Run - Bressler 1980, Canfield Island - Bressler, Maietta and Rockey 1983, Quiggle - Smith 1984). It is suggested here that although population grew between the end of the Clemson Island period and the beginning of the Shenks Ferry period, the populations were more concentrated and could again be focused on the mouth of Bald Eagle Creek. There would be no need for outlying communities and none are present at West Water Street. This scenario of local settlement pattern shifts is admittedly hypothetical. However, similar settlement pattern changes have been noted in other parts of the Middle Atlantic region (e.g. - Custer 1984:99-100) where especially rich environmental zones attracted settlement and population growth outruns space and local carrying capacity. Further research in the Lock Haven area may be able to test this scenario of local settlement pattern growth and development. In conclusion, the excavation of the Clemson Island component of the West Water Street Site provided data that can be used to learn about local Late Woodland prehistoric lifeways in the West Branch Valley of the Susquehanna River and to frame research questions for future study.

LATE ARCHAIC - MIDDLE WOODLAND COMPONENT EXCAVATION RESULTS

Introduction

Phase II test excavations at the West Water Street Site had identified what appeared to be a separate prehistoric cultural occupation located directly below the Clemson Island occupation and above the Middle Archaic occupation (Watson et al. 1992). The only diagnostic artifacts recovered from this occupation were two stemmed projectile points, which were thought to date somewhere within the Late Archaic to Middle Woodland cultural periods. Figure 5 shows the vertical position of this occupation as determined from Phase II testing. Data Recovery excavation of this component at the West Water Street Site was designed to further identify and define the occupation, and a series of 1 m sq. test units were excavated in Segment D of Section III for this purpose (Figure 28).

Diagnostic projectile points from the Late Archaic through Middle Woodland Periods were recovered from the Phase III test units (Figure 72, Table 43), and included Susquehanna broadspears and a variety of stemmed and notched types. A number of tools and flakes were also found in these units. As noted earlier in this report, however, these artifacts were found in excavated levels along with artifacts from the later Contact and Clemson Island occupations. No intact Late Archaic - Middle Woodland occupation surface or artifact deposit was encountered, and all of the diagnostic artifacts from this period were recovered from disturbed contexts. Additional diagnostic artifacts from the Late Archaic - Middle Woodland Period were found in Clemson Island features as well, but these artifacts are also from disturbed contexts.

FIGURE 72

Sample Projectile Points from the Late Archaic-Middle Woodland Occupation

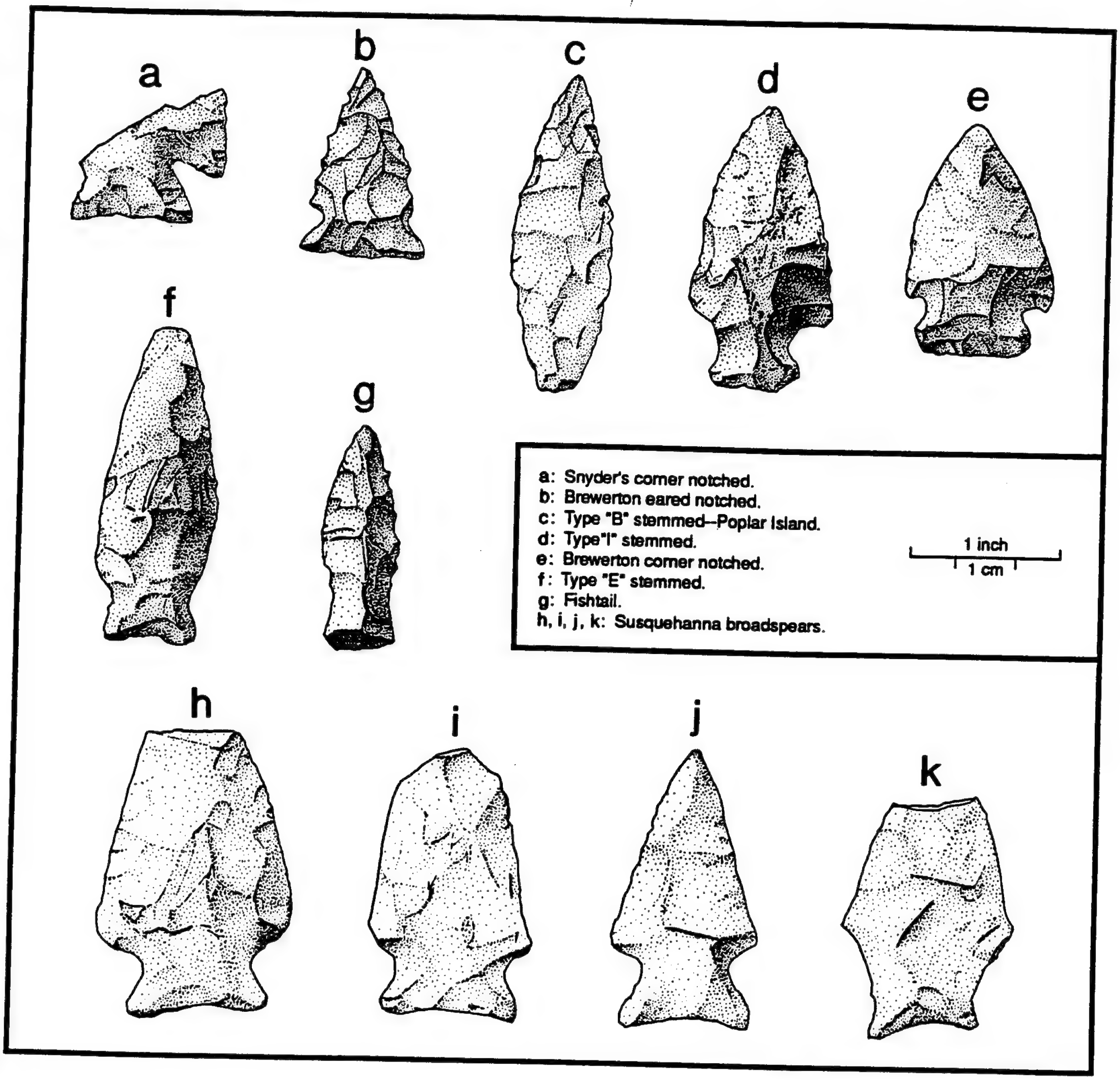


TABLE 43
Projectile Points from Late Archaic - Middle Woodland Component

Type	Number	Citation
Brewerton Corner-Notched	1	Ritchie 1961:16
Brewerton Eared-Triangle	4	Ritchie 1961:18
Brewerton Eared-Notched	2	Ritchie 1961:17
Type "I" Stemmed	1	Kent 1970:145
Type "E" Stemmed	1	Kent 1970:135
Type "B" Stemmed	1	Kent 1970:131
Fishtail	3	Ritchie 1961:39
Susquehanna Broadspear	24	Ritchie 1961:53
Snyder's Corner-Notched	1	Ritchie 1961:49
Generalized Corner-Notched	11	
Generalized Side-Notched	9	
Generalized Straight Stem	4	
Generalized Contracting Stem	2	
Generalized Expanding Stem	3	
Drill-Untyped	1	
Unidentified	8	

Given the disturbed nature of the shallow portions of the West Water Street Site, any analysis or interpretation of the Late Archaic - Middle Woodland Component must necessarily be limited to only those artifacts that have been demonstrated elsewhere to be associated with, and specific to, that time period. At the West Water Street Site, these artifacts would include Susquehanna broadspears from the Late Archaic Period, and stemmed and notched projectile points from the Late Archaic through Middle Woodland Periods. No prehistoric ceramics earlier than Clemson Island wares were recovered, and no features could be clearly associated with this time period either.

Chronology

Table 43 lists the projectile points from the Late Archaic - Middle Woodland component and a few of these types yield chronological information. The Brewerton varieties (corner notched, eared triangle, and eared notched - Figures 72b and 72e) are associated with the Laurentian Tradition, which is dated to ca. 3200 B.C. - 2000 B.C. in New York (Funk 1988:35), and Turnbaugh (1977:104-120) suggests that similar dates can be inferred for the West Branch Valley. The three stemmed point types (Figures 72c-d, 72f) defined by Kent (1970) date to a similar time frame. The fishtail variety (Figure 72g) dates to ca. 1200-700 B.C. (Kinsey 1972) and the Susquehanna Broadspears (Figures 72h-k), the most abundant type in the assemblage, date to ca. 2000-1000 B.C. (Custer n.d.a). The Snyder's corner notched point (Figure 72a) is a rare variety for this region and dates to ca. 200 B.C. - A.D. 200 (Ritchie 1961:49). The generalized stemmed and notched varieties could date to anywhere between 3000 B.C. and A.D. 1000. In general, the projectile point assemblage dates cover the entire Late Archaic - Middle Woodland time period and their co-occurrence reinforces the idea that artifacts from a relatively long time period are mixed with one another in this upper stratigraphic section of the site.

Even though these Late Archaic - Middle Woodland components are badly mixed, it is possible to tentatively separate artifacts associated with Susquehanna broadspears during the later portion of the Late Archaic. All but two of the 24 Susquehanna broadspears from the site are manufactured from rhyolite and Turnbaugh (1977:146-153) notes that rhyolite is the dominant raw material used between 2000 B.C. and 1000 B.C. in the West Branch Valley. Analysis of the distributions of rhyolite artifacts by Stewart (1984) also supports this contention. Therefore, for the purposes of this analysis, all rhyolite artifacts form the upper stratigraphic unit of the West Water Street Site are assumed to date to the time period of 2000-1000 B.C. and will be analyzed as a single component. It is important to note, however, that this assumption may not be completely valid. Nevertheless, we are sufficiently convinced of its utility to let this assumption define an assemblage of artifacts for special analysis.

Rhyolite Artifact Analysis

Table 44 provides a summary catalog of all rhyolite artifacts recovered from the upper stratigraphic unit of the West Water Street Site and includes artifacts recovered from test units, features, and the general surface collection. Susquehanna broadspears represent the most common tool type in the assemblage, which also includes a fishtail projectile point, a corner-notched point, early and late stage bifaces, flake tools, utilized flakes, and debitage.

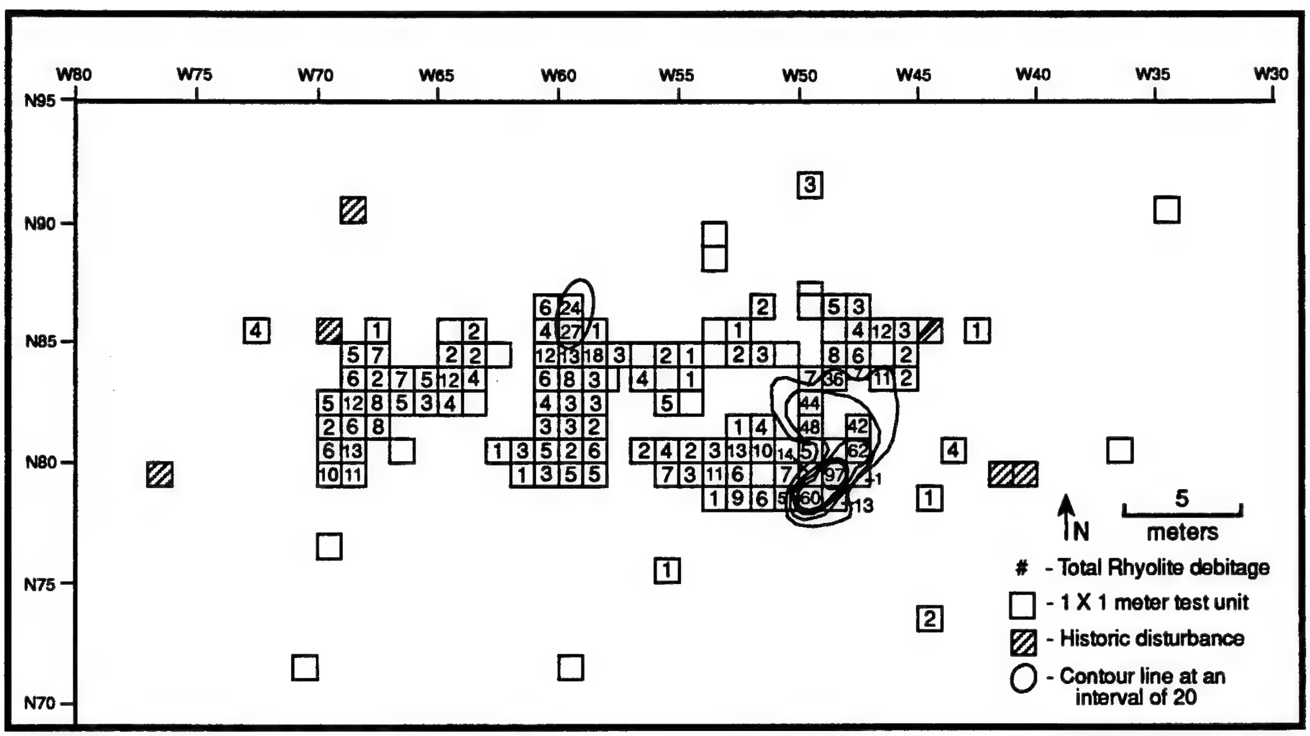
Figure 73 shows the horizontal distribution of rhyolite debitage recovered from test units during Phase III excavations at the West Water Street Site. The numbers of flakes shown on the map are the totals of all levels of the individual test units. The majority of the excavation area shows an even distribution of rhyolite debitage, with the exception of the southeast corner. In this location, there is a dramatic increase in the number of rhyolite flakes, suggesting that episodes of biface or core reduction took place in this section of the site.

<u>Broadspears</u>. A total of 24 Susquehanna broadspears were recovered from the West Water Street Site and four are illustrated (Figure 72h-k). All but two of the broadspears are manufactured from rhyolite; the other two are made from chert. The majority of the rhyolite broadspears are manufactured from banded rhyolite (63%), but aphanitic and mottled varieties are also present. One broadspear is made from porphyritic rhyolite. Three of the broadspears are complete specimens and the remaining broadspears are fractured. Three show fractures resulting from impact, and 15 have transverse fractures in the medial section. One of the broadspears with a transverse medial fracture appears to have been sharpened into a drill prior to the fracture. Another broadspear is damaged in the distal region from what appears to be a manufacturing error, and two broadspears have had their distal sections reworked into scraping implements. Four of the broadspears in the assemblage are asymmetrical in plan view,

TABLE 44
Summary Catalog of Rhyolite Artifacts from Upper Stratigraphic Unit

Artifact Type	Number
Susquehanna Broadspear	22
Fishtail Point	1
Corner-Notched Point	1
Fishtail/Broadspear Base	1
Stemmed Point Base	1
Early Stage Biface Reject	3
Late Stage Biface Reject	20
Biface Fragments	5
Flakes (cortex)	6014(1)
Utilized Flakes	115
Flake Tools	8
Side Scrapers	3
Other Tools	5
Miscellaneous Stone Tools	1
Shatter (cortex)	4(1)
Total (cortex)	**6196(2)**

FIGURE 73
Distribution of Rhyolite Debitage in Upper Stratigraphic Unit



and four have been resharpened in the medial section, producing alternate beveling of the edges.

Length measurements were obtainable for only three of the broadspears; the mean length was 4.53 cm. Widths of the broadspears ranged from 3.75 to 2.13 cm, with a mean of 2.86 cm (n = 21). The mean thickness of the broadspears was 0.68 cm (n = 24). Length/width and width/thickness ratios were also calculated for these artifacts, were possible. The mean length/width ratio is 1.66, and the mean width/thickness ratio is 4.49 (n = 21).

It is interesting to compare the attributes of the West Water Street broadspear assemblage with other samples of broadspears. Data on a sample of 324 broadspears from the West Branch Valley was provided by Gary Fogelman of Turbotville and this sample provides an important basis for comparison. Additional samples from other parts of the Middle Atlantic region (Custer 1991) also provide a basis for comparison. Fogelman's sample of 324 broadspears contains 223 Susquehanna specimens (69%) thus demonstrating that this type is the most common broadspear variety in the West Branch Valley. Of the 223 Susquehanna broadspears, 215 (96%) are manufactured of rhyolite. This overwhelming proportion of rhyolite use in the larger sample provides additional support for the assumption that rhyolite artifacts in the upper stratigraphic unit of the West Water Street Site are related to the Susquehanna broadspear time period. Yet more support for this contention is provided by the observation that of the 101 non-Susquehanna broadspears in the Fogelman sample, only 48 (46%) are manufactured from rhyolite. Application of the difference of proportion test confirms that the difference in rhyolite percentages between the Susquehanna and non-Susquehanna broadspears are indeed statistically significant with rhyolite use among Susquehanna broadspears nearly double that of other broadspear types.

Fifteen of the 24 Susquehanna broadspears in the West Water Street Site sample (62%) showed transverse medial fractures typical of knife usage. In the Fogelman sample, 115 of the 223 Susquehanna broadspears (52%) showed similar fractures and there is no statistically significant difference between the two samples. Larger samples of broadspears from the Middle Atlantic region (Custer 1991:60) show very similar frequencies of transverse fractures.

Impact fractures more typical of projectile point use occur on three of the West Water Street specimens (12%) and on seven specimens from the Fogelman sample (3%). This difference is statistically significant with the West Water Street Site showing more signs of projectile point use. Research on large samples of broadspears (Custer 1991:67-69) has shown that broadspear breakage patterns are directly related to point width. Specimens with widths of 30 mm or less are more likely to show signs of projectile point use than larger specimens. As noted earlier, the mean width of the West Water Street sample is 29 mm; therefore, the higher proportion of projectile point usage is not

surprising. In sum, the West Water Street Susquehanna broadspears were multi-function tools used as both knives and projectile points.

Bifaces. A total of 28 bifaces, or biface fragments, made of rhyolite were recovered from the West Water Street Site. Included in this total are 20 late stage biface rejects and three early stage biface rejects. These are bifaces that do not exhibit hafting elements (Lowery and Custer 1990). Also included are five broken biface fragments which could not be further identified.

Five of the late stage bifaces are the distal or tip portions of larger bifaces. None of these distal fragments show impact fractures, or have been reworked. They are probably the distal portions of bifaces which have been fractured transversely in the medial section. Three of the rhyolite bifaces are proximal, medial, and distal portions of narrow bifaces which have been broken due to manufacturing errors. Two biface fragments are refitting pieces which form the medial and distal portions of a narrow biface with a transverse medial fracture. This biface may have fractured during use, which is what might have caused the original, complete biface to fracture.

Five of the late stage bifaces are unbroken, and appear to have been rejected due to manufacturing errors, or raw material flaws which made further reduction impractical. Two of these bifaces are large and roughly triangular in shape; one has been utilized, but the other has not. The other three were rejected due to an apparent inability to reduce their thickness. One other late stage biface fragment is a wide, thin form which may have been a broadspear preform.

The remaining late stage biface fragments are small in size. One is probably the medial section of a drill, and another is the lateral edge of either a finished projectile point or broadspear, or the edge of a late stage biface. A third is the medial section of a late stage biface which appears to have been broken during use. The final late stage biface is a very small basal fragment, possibly from either a broadspear or fishtail point.

Three early stage rhyolite bifaces were found during Phase III excavations at the West Water Street Site. One is a large primary biface which was rejected due to a large number of inclusions in the material. The other two are distal sections of smaller bifaces, which were broken during manufacture. In sum, the important point to note about the biface assemblage is that it clearly shows that biface reduction took place at the site.

Flake Tools. Three scrapers made of rhyolite were recovered from the West Water Street excavations. Two of these are convergent straight-sided scrapers, and one is a double straight-sided scraper, as defined by Lowery and Custer (1990). These are flake tools which have been reworked along their lateral edges, but not along their distal or proximal ends. All of these tools

show moderate wear, and were not heavily used. The remaining five flake tools are flakes with a moderate amount of reworking that did not fit into formal tool definitions. These flake tools are probably generalized cutting tools.

A total of 115 utilized rhyolite flakes were recovered from test units and features at the site. These are flakes that have been utilized but not reworked. The majority of the utilized flakes show wear on only one edge, and appear to have been expediently used.

Miscellaneous Stone Tools. A small fragment of what appears to be the medial section of a rhyolite drill was found at the site. It is nearly round in cross-section, and may have come from a broadspear resharpened into a drill.

Debitage. A sample of rhyolite debitage from the Late Archaic Susquehanna Broadspear component was analyzed using methods devised by Lowery and Custer (1990:97-99) to determine the relative extent to which rhyolite core and biface reduction took place at the site. Fifty rhyolite flakes comprised the sample of debitage, and this sample is a very small portion (<1%) of the total assemblage. However, it is important to remember that the absolute size of the sample is the critical factor in assessing the adequacy of the sample, not the sampling fraction; therefore, the 50 flake sample is adequate for analysis.

Table 45 lists the flake attribute data for the Late Archaic sample from West Water Street, a sample from the Caledonia rhyolite quarries near Gettysburg, and typical biface and core reduction control samples (Riley, Custer, and Hoseth 1993:Appendix II). In general, the West Water Street data show a mix of core and biface reduction activities. For example, with regard to flake type attributes, the West Water Street assemblage is most similar to the biface reduction control sample. Flake size and remnant biface edge attributes also show such similarities. However, with regard to platform shape and platform preparation, the West Water Street assemblage is more like the core reduction control sample.

Consideration of the Caledonia Quarry sample also lends some insights on rhyolite use at the West Water Street Site. The debitage sample form the Caledonia Quarry came from an area where large exfoliated plates, or slabs, of rhyolite were being reduced to rather crude and thick primary bifaces. These bifaces all have a large number of flaking scars on the dorsal surface of the initial plate or slab, and few signs of flaking on the ventral surface. Removal of flakes was more directed at reducing the thickness of the original plate than it was at edging the biface. Therefore, there are few remnant biface edges on flakes and few signs of platform preparation. Flake scar counts and directions are also high and reflect this activity. The large biface that resulted from this initial reduction was probably the main

TABLE 45
Flake Attribute Data- Broadspear Component

	West Water Street	Caledonia Quarry	Typical Biface	Typical Core
Flake Type				
Complete	36	68	12	63
Proximal	34	18	28	19
Medial	22	0	26	4
Distal	8	14	35	14
Size				
< 2 cm	66	4	78	49
2-5 cm	32	82	20	46
> 5 cm	2	14	2	5
Platform Shape				
Triangular	14	10	81	10
Flat	12	28	7	37
Round	44	48	12	35
No Observation	30	14	0	18
Remnant Biface Edge				
Present	8	0	19	3
Absent	92	100	81	97
Platform Preparation				
Present	16	20	88	10
Absent	54	66	12	72
No Observation	30	14	0	18
Flake Scar Count				
Mean	2.48	2.26	2.00	1.33
Standard Deviation	1.40	.96	.95	1.22
Flake Scar Direction Count				
Mean	2.32	1.76	1.73	.73
Standard Deviation	.99	.65	.78	.60

Note: All data are percentages.

artifact form transported away from the quarry to sites like West Water Street.

Comparing specific attributes of the West Water Street and Caledonia assemblages shows similarities and differences. The lower incidence of complete flakes in the West Water Street sample suggests that later stages of biface reduction was taking place where increased emphasis on biface thinning produces more broken flakes (Gunn and Mahula 1977). The increased incidence of smaller flakes would indicate that later stages of reduction were producing smaller bifaces, and, consequently, smaller flakes. Similar distributions of platform shapes and platform preparation, not at all like the biface reduction control sample, may be a peculiarity of the use of rhyolite. The higher incidence of remnant biface edges in the West Water Street assemblage probably represents the later stages of biface reduction as do the higher counts of flake scars and flake scar directions. For the most part, the rhyolite debitage from West Water Street shows that the large bifaces produced at quarry sites were further reduced as they were transported away from the quarries. There was little emphasis on production of flakes for tools and this observation is supported by the low incidence of flake tools and utilized flakes in the rhyolite assemblage (Table

44). Expedient use of rhyolite flakes, which required few formal tools and left few signs of edge damage, may have occurred, however.

Steatite Artifacts

A total of 38 steatite fragments were recovered from test units and features at the West Water Street Site. Soapstone, or steatite, was used during Late Archaic times to manufacture bowls that were the precursors to ceramic containers in the Susquehanna Valley (Ward and Custer 1988). This material was also used to manufacture pipes, beads, and other ornaments during other time periods (e.g. - Kent 1984:148-150). In some cases, bowl fragments were "recycled" into ornaments (Turnbaugh and Schmidt 1979).

The steatite artifacts from West Water Street are small and most appear to be bowl fragments. Because the fragments are small, little can be said about the bowl sizes or configurations; however, it can be noted that none of the bowl sherds indicate that they were atypical of varieties reported in the literature (Ward and Custer 1988). Drilled holes are present in three steatite bowl fragments and these holes are probably related to bowl repair rather than ornament production.

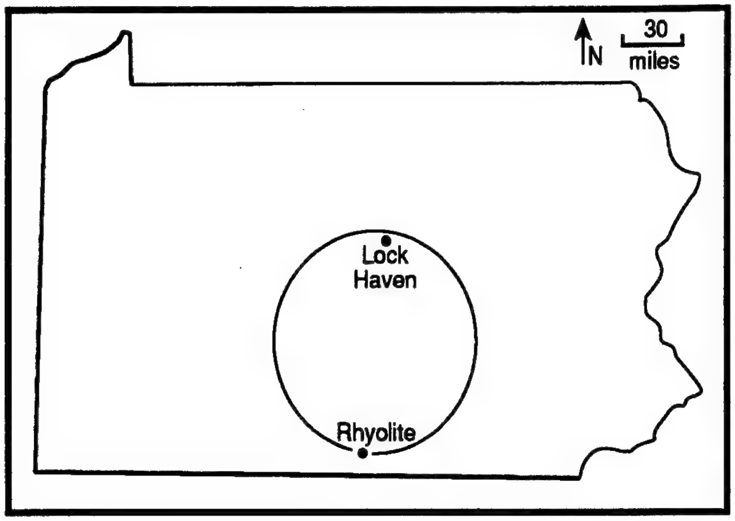
Discussion

The presence of rhyolite Susquehanna broadspears and soapstone bowl fragments at the West Water Street Site is good evidence for a series of occupations of the site during Late Archaic times. The disturbance of the artifacts from this occupation by later Clemson Island and Contact Period occupations makes it difficult to assess the number of occupations, their duration, and any cultural changes that occurred during the time span of these occupations. Furthermore, only rhyolite artifacts can be considered to date from this time period, and there is no way to clearly identify lithic artifacts of other raw materials from this period. Nonetheless, the range of rhyolite artifacts recovered suggests that one or more base camps were present.

The nearly exclusive use of rhyolite for the manufacture of Susquehanna broadspears, the absence of other broadspear forms, and the presence of steatite bowl fragments all place this Late Archaic occupation firmly within the "Susquehanna Tradition" (Turnbaugh 1977:142-153). Turnbaugh (1977:142) notes the presence of over 100 sites in the lower West Branch Valley which show similar occupations and all show significant reliance on rhyolite. Rhyolite has a restricted range of outcrops in the Blue Ridge physiographic province of the Middle Atlantic region (Stewart 1984, 1987) and the outcrops of rhyolite closest to the Lock Haven area are located more than 100 km to the south in the South Mountain area near Gettysburg in Adams County. The intensive reliance on rhyolite is generally restricted to the Late Archaic Period in the West Branch Valley and, given the long distance to the source of rhyolite, it is rather extraordinary.

FIGURE 74

Hypothetical Late Archaic Territory



There is some debate as to whether rhyolite made its way to the West Branch Valley via trade and exchange or direct trips to the quarries (Stewart 1984; 1989). The intensive reliance on rhyolite makes direct procurement more likely and it is possible that individual Late Archaic groups traveled through a territory that stretched from the West Branch Valley of the Susquehanna River on the northern edge of the Ridge and Valley physiographic province to South Mountain on its southern borders.

Figure 74 shows the smallest territory range that would include both the West Water Street Site and the nearest rhyolite quarries in Adams County. The diameter of the circle is approximately 100 miles (160 km) and the area of the territory is approximately 785 sq. miles (2010 sq. km). It is very likely that the Late Archaic group territory could have been even larger. As noted in the introduction to this report, the West Water Street Site is located in the transition zone between the Ridge and Valley and Appalachian Plateau physiographic zones. This transition zone is a major ecotone with different environments and resources found in each. The ready access to both physiographic zones makes the West Branch Valley an especially attractive area for prehistoric settlement and the valley's prehistoric inhabitants almost certainly ranged north into the Appalachian Plateau. Such an exploitation pattern would increase the size of the territory noted in Figure 74.

The territory noted in Figure 74 is somewhat larger than the Late Archaic territories hypothesized by Kent (1970). Nevertheless, the territory plotted in Figure 74 is well within the range of band territories reconstructed from the ethnographic and ethnohistoric record of Eastern North America (see discussion in Custer and Stewart 1990). In fact, it would fall toward the small end of the size range. Parry (1989) also suggests that Late Archaic groups were more mobile than originally thought, based on stone tool kit analyses, and similar notions have been

suggested based on data from the Coastal Plain of Delaware and New Jersey (Watson and Custer 1990). In conclusion, the Late Archaic occupation of the West Water Street Site is somewhat enigmatic due to its disturbed context, but it does provide data on various aspects of that period's prehistoric lifeways.

MIDDLE ARCHAIC COMPONENT EXCAVATION RESULTS

Introduction

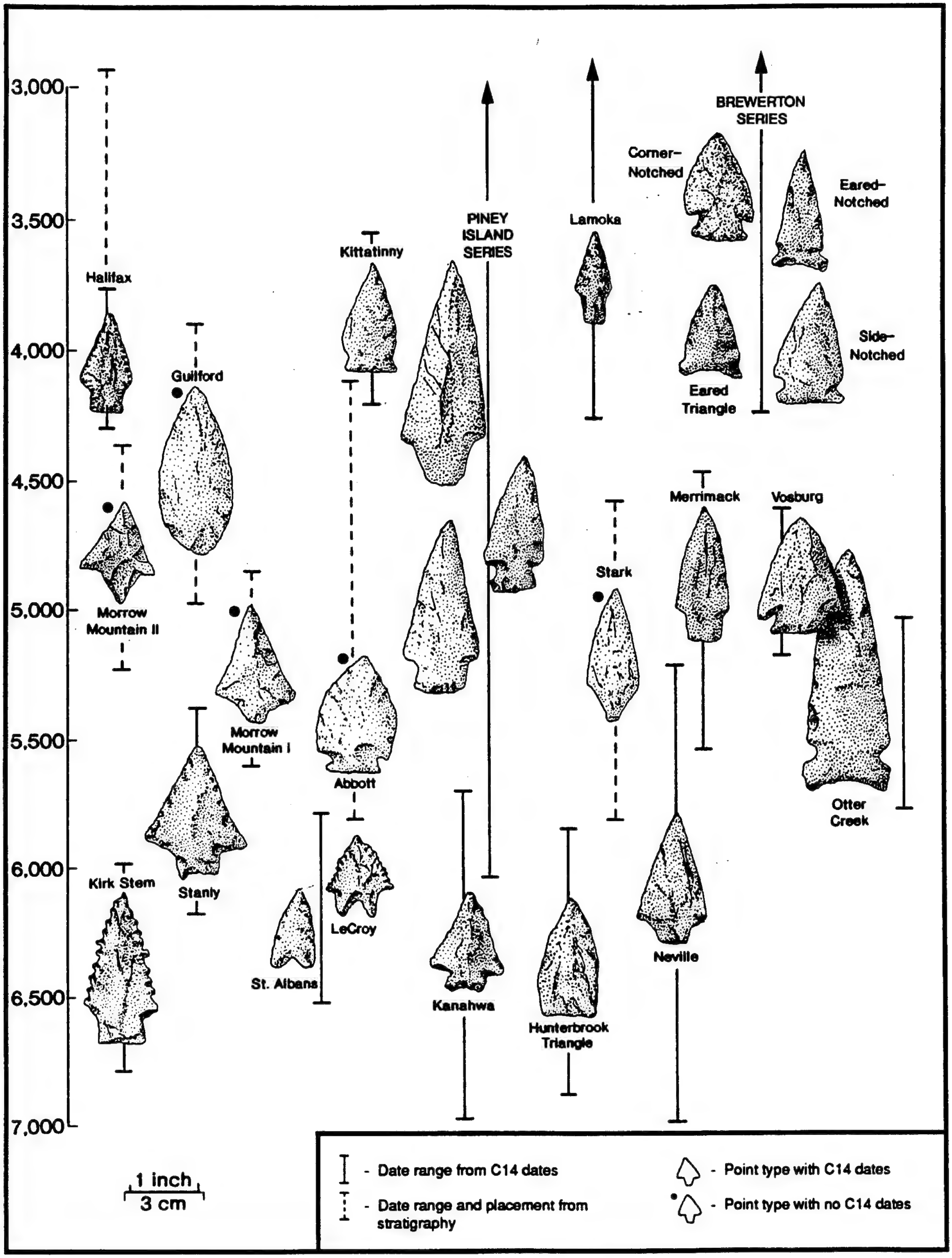
The Middle Archaic component of the West Water Street Site contains the most significant archaeological data at the site for a number of reasons. In the first place, very little is known about the Middle Archaic Period in the Middle Atlantic region. In a new book on Eastern Pennsylvania prehistory to be published by the Pennsylvania Historical and Museum Commission, the senior author of this report titled the chapter on the Middle Archaic as "The Lost Years" (Custer n.d.a). Throughout Eastern North America, extensive excavations at Middle Archaic sites are rather rare. There are only four classic sites which have been used to define the Middle Archaic and these include the St. Albans Site in West Virginia (Broyles 1971), the Neville Site in New Hampshire (Dincauze 1976), a series of sites in the North Carolina Piedmont (Coe 1964), and the Rose Island Site in eastern Tennessee (Chapman 1975). None of these sites are in the Middle Atlantic region and archaeologists in this region have had to look to adjacent regions for an understanding of this time period (e.g. - see review in Custer 1990).

There are some indications of Middle Archaic components at sites in the Middle Atlantic region (see reviews in Custer 1990, n.d.a; Stewart and Cavallo 1991). For example, Stewart and Cavallo (1991) have summarized recent excavations of a Middle Archaic component at the Abbott Farm Site in the Delaware Valley and a number of different activity areas were studied. Kent's (1970) excavations at Piney Island in the Lower Susquehanna Valley revealed some Middle Archaic components but the excavations were not extensive. The Indian Creek Site (LeeDecker and Holt 1991) in the Maryland Coastal Plain contained some Middle Archaic components, but its dating is uncertain. Very small Middle Archaic components were identified in the southern Delaware Coastal Plain (Custer and Mellin 1991).

In all of the Middle Atlantic examples noted above, except for the Abbott Farm locality, the samples of Middle Archaic artifacts recovered, and the site areas exposed, were rather small. Furthermore, the assemblages of projectile points, which can be used as diagnostic Middle Archaic artifacts, are rather varied and not easily understood. Figure 75 shows a summary of varied projectile point forms and their chronology for the central Middle Atlantic region. Because many archaeologists working in this region feel that a limited range of projectile point styles should be expected, some archaeologists do not believe that some of the sites noted above do indeed date to the

FIGURE 75

Middle Archaic Projectile Point Chronology



Middle Archaic Period. As a result of all of these factors, the Middle Archaic Period is the most poorly understood of all of the time periods in local prehistory.

Excavations at the West Water Street Site exposed a total of 470 sq. m of Middle Archaic deposits distributed among four different sections of the site. A large number of artifacts including projectile points, bifaces, flake tools, and debitage were recovered and the area and artifact samples are the largest recovered to date in the Middle Atlantic region. Unlike the case with the Clemson Island and Late Archaic - Middle Woodland occupations, the context of the Middle Archaic component is well defined and the archaeological deposits are not disturbed. Furthermore, the Middle Archaic component seems to represent a rather limited time interval and this fact further enhances its importance. The context of the Middle Archaic component will be described first. Then, the artifacts and their spatial relationships will be discussed.

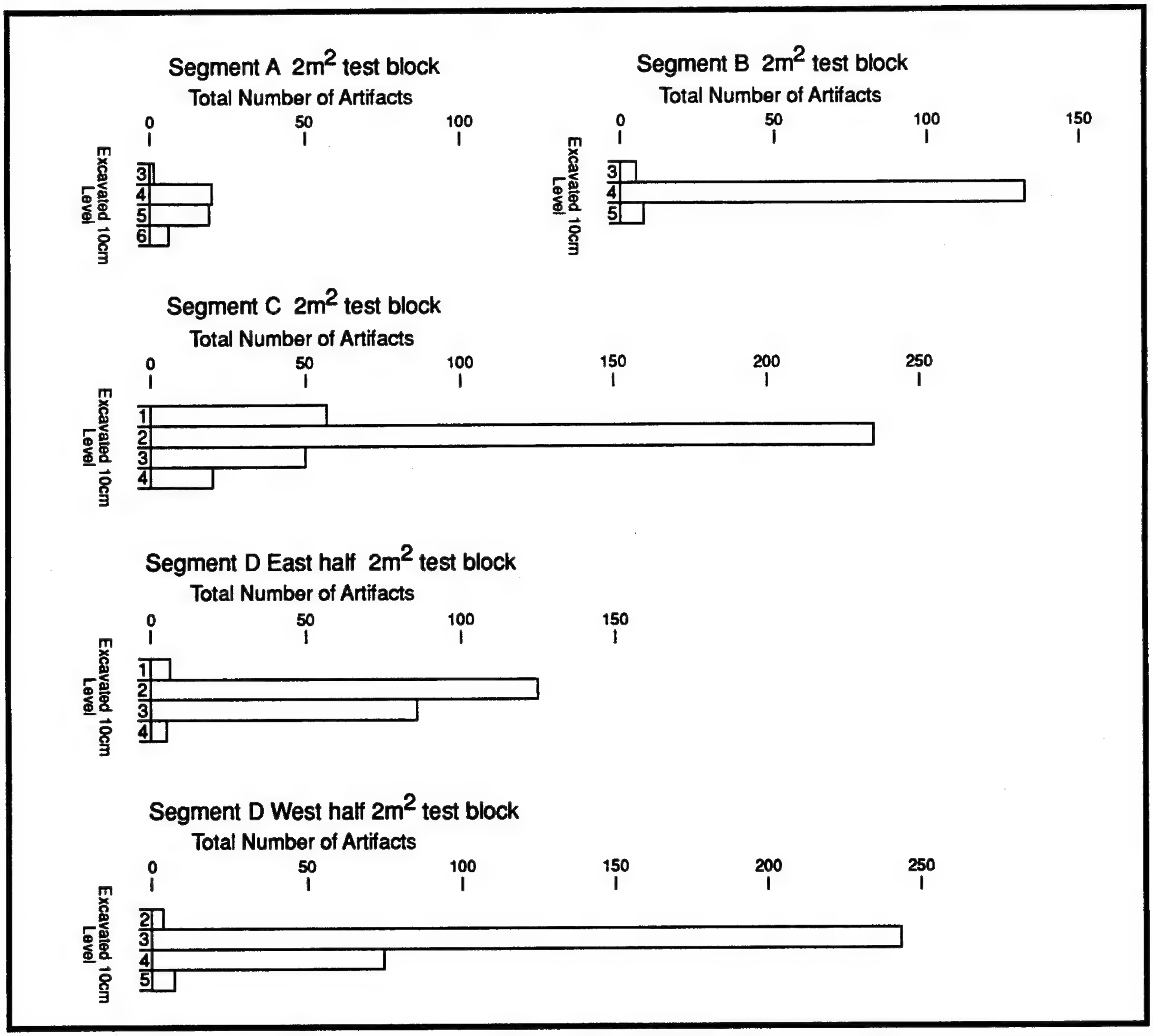
Context Analysis

This section of the report describes the context of the artifacts associated with the Middle Archaic occupation of the West Water Street Site, excavated in Segments A, B, C, and D (Figure 3). Phase II testing of this occupation indicated that the Middle Archaic artifacts were in good stratigraphic context, and were separated by sterile soils both above and below their vertical location. This information was confirmed during Phase III excavations as was noted in the earlier description of the site stratigraphy. In general, the artifacts from the Middle Archaic occupation were shown to have a confined vertical distribution in all four of the segments in which they were excavated. However, a limited amount of vertical artifact movement was observed. In only one place was the Middle Archaic occupation area shown to be disturbed. The northern-most two meters of the area stripped for Segment A were found to be located on a buried edge of the river bank. Units placed in this two meter by fourteen meter section contained both modern and prehistoric artifacts, and have therefore not been included in this analysis.

The depth of the Middle Archaic artifacts relative to modern ground surface was quite different within each excavation area. In most cases, however, the artifacts were recovered from a 20 to 30 cm thick area (i.e., from two to three 10 cm thick excavation levels). In Segment A, artifacts were concentrated in Levels 2 through 4 below the top of the mechanically stripped surface in the southeast corner of the segment, in Levels 4 through 6 in the southeast corner, and in Levels 6 through 8 in the west half of the segment. In Segment B, artifacts were concentrated in the area from 20 to 40 cm below the stripped surface. In Segment C, artifacts were recovered from the top of the stripped surface to a depth of 50 cm, but in the west half of this segment they were predominately found from 0 to 30 cm, and

FIGURE 76

Vertical Distribution of Middle Archaic Artifacts



in the east half from 20 to 40 cm. In the east half of Segment D, the majority of artifacts were found from 10 to 30 cm below the top of the stripped surface. In the west half they were recovered from 20 to 40 cm below the top of the stripped surface.

Figure 76 shows the vertical distribution of artifacts by 10 cm excavated levels from a 2 m sq. area of each segment. This figure gives a graphic example of the tight clustering of artifacts within a 20 to 30 cm thick zone. In Segments B, C, and the west half of D, a dramatic increase in artifact numbers can be seen between two 10 cm levels. This tight vertical clustering of artifacts is indicative of a single, or small number, of artifact depositions, and a single, or small number, of occupation events in each individual segment. The artifacts are

not contained within a single 10 cm level, however, so some limited post-depositional artifact movement is implied. The decrease in artifact numbers both directly above and directly below the main artifact bearing level is suggestive of their displacement by natural processes. The extent of vertical displacement matches the empirical data on artifact displacement derived from studies of reconstructed cores (e.g. - Carr 1986; Custer and Watson 1985). These processes could include such actions as rodent and/or root disturbance, and soil freeze/thaw episodes.

Additional evidence that the Middle Archaic artifacts in each individual segment were deposited in a single event, or in a number of closely spaced events, comes from the soil horizons in which the artifacts were found. This information has been previously discussed at length in this report in the section on site stratigraphy, but the important points regarding Middle Archaic artifact context are the stability of the profile and the presence of a single buried A Horizon. The association of well developed B Horizons and the single A Horizon with the Middle Archaic artifacts in all four segments indicates rapid burial of the living surface and a short time frame of soil deposition. These soils suggest that the living surface was exposed long enough to develop an A Horizon, but not long enough to accommodate a lengthy series of Middle Archaic occupations and their associated artifacts.

No evidence of more than one Middle Archaic occupation at the West Water Street Site was indicated by the artifacts themselves. In each segment, only diagnostic projectile point types from the Middle Archaic were encountered: bifurcate points and a triangular point in Segment A, and Neville/Stanly points in Segments B, C, and D. No diagnostic artifacts from earlier or later periods were found in context with the Middle Archaic artifacts. It is suggested here that the Middle Archaic artifacts are in good stratigraphic context, both vertically and horizontally, and represent a single occupation or small number of closely spaced occupations. The various points, tools, and other artifacts may therefore be considered as representing a small point in time. Because of this, the artifacts from all excavated levels of the Middle Archaic occupation are being combined, without regard to their vertical distribution, for purposes of analysis.

Chronology

Projectile point styles and radiocarbon dates are the main sources of chronological data for the Middle Archaic component of the West Water Street Site. Each of these data sources is described below.

Projectile Points. In discussing the chronological information that can be gained from the projectile point assemblage, it is important to state a key assumption used in our analysis. Based on the clear contextual integrity of the

FIGURE 77

Middle Archaic Projectile Points from Segments A, B, and C

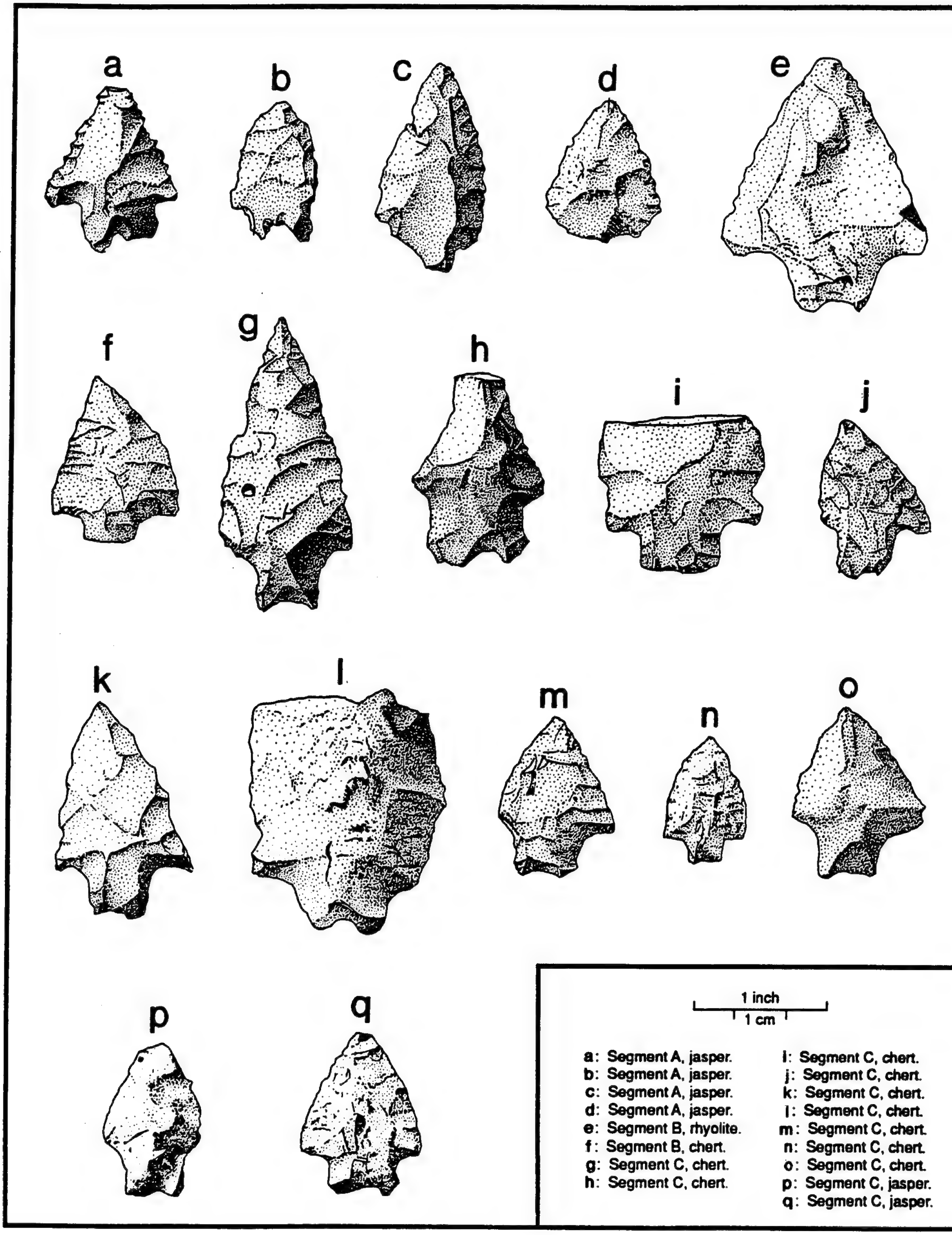
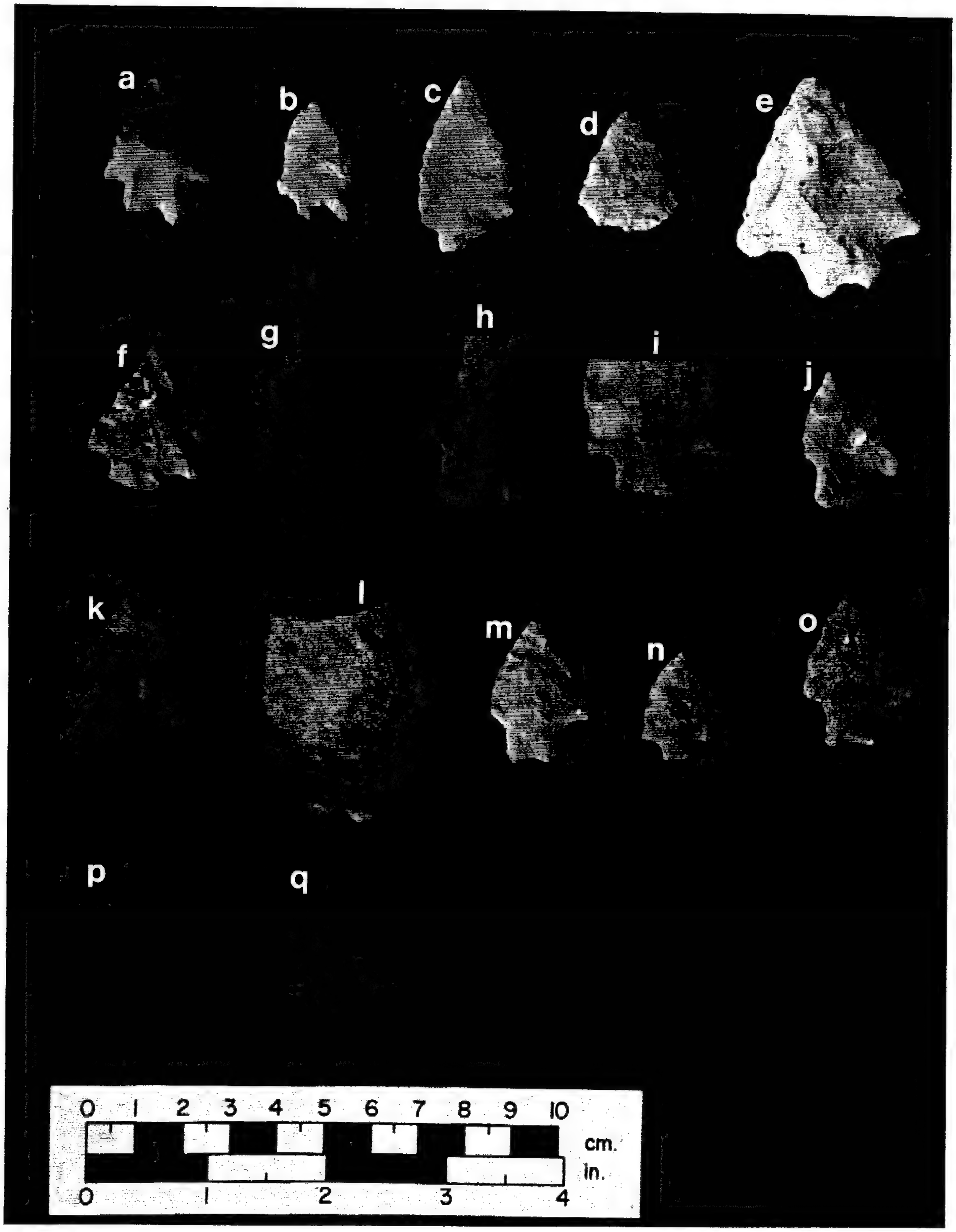


PLATE 1

Middle Archaic Projectile Points from Segments A, B, and C



A: Segment A, jasper.	G: Segment C, chert.	M: Segment C, chert.
B: Segment A, jasper.	H: Segment C, chert.	N: Segment C, chert.
C: Segment A, jasper.	I: Segment C, chert.	O: Segment C, chert.
D: Segment A, jasper.	J: Segment C, chert.	P: Segment C, jasper.
E: Segment B, rhyolite.	K: Segment C, chert.	Q: Segment C, jasper.
F: Segment B, chert.	L: Segment C, chert.	

TABLE 46
Middle Archaic Point Types by Segment

Area	Point Type	Count
A	Bifurcate	3
	Triangular	1
	Unidentified	2
	Sub-total	6
B	Neville/Stanly	2
	Unidentified	3
	Sub-total	5
C	Neville/Stanly	11
D	Neville/Stanly*	34
	Unidentified	1
	Sub-total	35
Combined	Bifurcate	3
	Triangular	1
	Neville/Stanly	47
	Unidentified	6
	Total	**57**

*Includes stem fragments

sediments of this "pre-Late Archaic" component described previously, its stratigraphic position well beneath (and separate from) the Late Archaic broadspears and other Late Archaic artifacts, and the discovery of well-defined Middle Archaic projectile point types in these strata during the Phase II excavations, we feel that the associations of projectile points discussed below are valid associations that were not produced by mixing of archaeological deposits from other time periods. In our analysis, the context is used to define artifact assemblages. Variability observed in assemblages thus defined is viewed as the true variability of in the chipped stone tool kits of the Middle Archaic inhabitants of central Pennsylvania. If that variability is greater than what we may have expected to see, the problem is with our expectations, not with the context of the artifact assemblages that contradict our expectations. Table 46 summarizes the projectile points found in each segment. Figures 77 and 78 and Plates 1 and 2 illustrate the Middle Archaic projectile points.

Four diagnostic projectile points were recovered from Segment A and are illustrated in Figure 77 (a-d). Three of the points from this segment (Figure 77a-c) have bifurcate bases. Three basic varieties of bifurcate base projectile points are known from Eastern North America: Kanawha, LeCroy, and St. Albans (Broyles 1971:58-59, 68-69, 74-75). The three specimens from Segment A of the West Water Street Site most closely resemble examples of the LeCroy variety. LeCroy points were associated with a radiocarbon date of 6300 B.C. at the St. Albans Site and an inferred date range of 6500-5500 B.C. for eastern Pennsylvania is suggested by Custer (n.d.a) based on dates from a variety of sites throughout the Middle Atlantic and Northeast.

The fourth point from the Middle Archaic component of Segment A is a triangular point (Figure 77d). Triangular points

are usually thought of as being diagnostic indicators of the Late Woodland Period and numerous triangular points were found in association with the Late Woodland Clemson Island component of the West Water Street Site. However, Stewart and Cavallo (1991) note the presence of triangular projectile points in Middle Archaic contexts at the Abbott Farm Site in the Delaware River Valley. Triangular points have also been noted in pre-Late Woodland contexts at sites in the New Jersey Coastal Plain (Cavallo 1981) and in southern New England (Snow 1980). The well-defined stratigraphic context of the Middle Archaic component of the West Water Street Site and the association of the triangular point with the LeCroy bifurcate points makes it virtually impossible for the triangular point illustrated in Figure 77d to date to any time period other than the Middle Archaic.

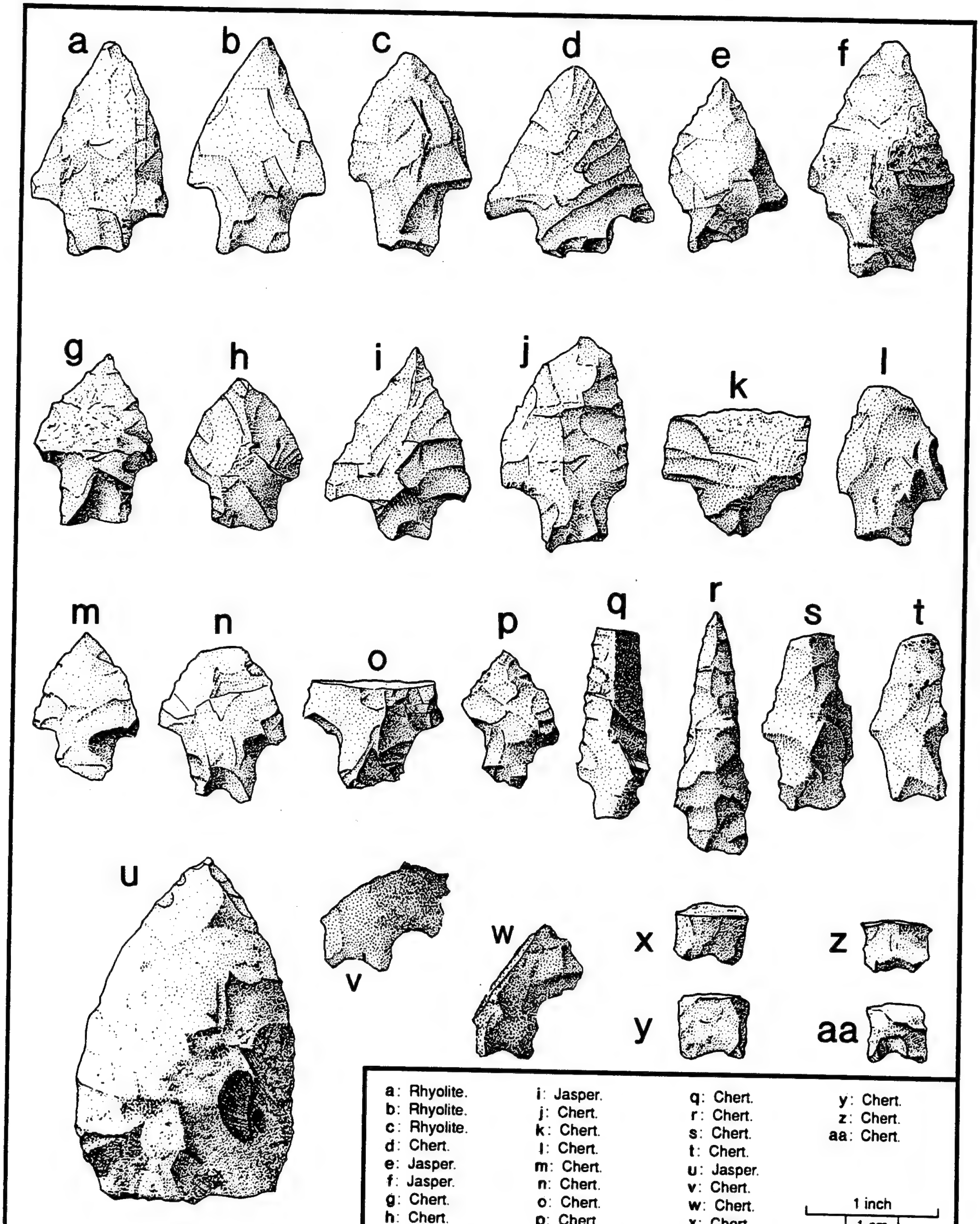
Examination of collections of pre-Late Woodland triangles by the senior author of this report suggests that basal thinning of early triangular points was almost always the last step in projectile point manufacture as indicated by the sequence of flake scars. In contrast, no such pattern seems to be present on Late Woodland triangular points. The Middle Archaic triangular point from Segment A clearly shows a final basal thinning scar and fits with the patterns noted above. In sum, the projectile point assemblage from Segment A (Figure 77a-d) clearly resembles other Middle Archaic assemblages from surrounding regions and probably dates to the time period between 6500 and 5500 B.C. The presence of a triangular point in this assemblages is not anomalous and does not represent an intrusive later artifact. Rather, it confirms Stewart and Cavallo's (1991) assertion that triangular points do occur in Middle Archaic assemblages. The co-occurrence of the bifurcate and early triangular point at the West Water Street Site can be expected given the range of radiocarbon dates reported for each type in the literature as shown in Figure 75 (Custer n.d.a:Chapter 3).

Two projectile points were recovered from Segment B (Figure 77e-f). The larger of the two points (Figure 77e) closely resembles the Neville type described by Dincauze (1976:28) and the Stanly type described by Coe (1964:35-36), although it is somewhat larger than the more typical specimens. The Neville type has been dated to the time period between 6500 and 5000 B.C. in New England (Dincauze 1976:25-29; Snow 1980). The specimen illustrated in Figure 77f does not specifically resemble any of the Middle Archaic types noted in Figure 75. The basic blade form and stem configuration do resemble those of Neville points; however, this specimen lacks the indented base that characterizes Neville and related Stanly forms. It is possible that this point is an unfinished Neville point.

Eleven diagnostic projectile points were recovered from Segment C and are illustrated in Figure 77g-q. All of these specimens are examples of the Neville/Stanly variety and probably date to the time period between 6500 and 5000 B.C. There is considerable variability in point size and shape in this

FIGURE 78

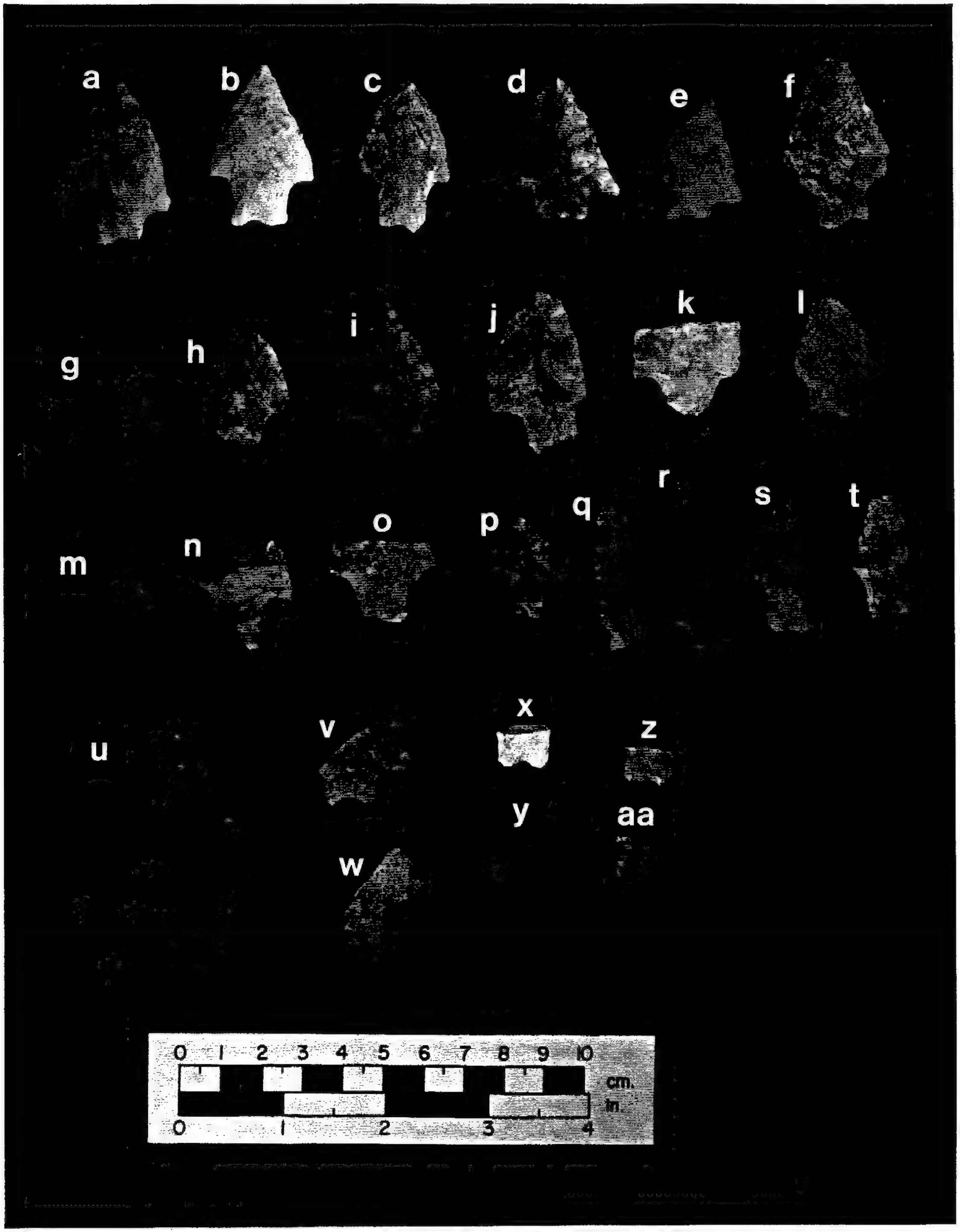
Middle Archaic Points from Segment D



a: Rhyolite.	i: Jasper.	q: Chert.	y: Chert.
b: Rhyolite.	j: Chert.	r: Chert.	z: Chert.
c: Rhyolite.	k: Chert.	s: Chert.	aa: Chert.
d: Chert.	l: Chert.	t: Chert.	
e: Jasper.	m: Chert.	u: Jasper.	
f: Jasper.	n: Chert.	v: Chert.	
g: Chert.	o: Chert.	w: Chert.	
h: Chert.	p: Chert.	x: Chert.	

PLATE 2

Middle Archaic Points from Segment D



A: Rhyolite.	I: Jasper.	Q: Chert.	X: Chert.
B: Rhyolite.	J: Chert.	R: Chert.	Y: Chert.
C: Rhyolite.	K: Chert.	S: Chert.	Z: Chert.
D: Chert.	L: Chert.	T: Chert.	AA: Chert.
E: Jasper.	M: Chert.	U: Jasper.	
F: Jasper.	N: Chert.	V: Chert.	
G: Chert.	O: Chert.	W: Chert.	
H: Chert.	P: Chert.	X: Chert.	

assemblage and this variability is probably related to the different functions for which the points are used. Further discussion of projectile point function is presented later in this section of the report.

All of the 46 diagnostic projectile points recovered from the Middle Archaic component of Segment D (Figure 78, exclusive of u, illustrates a sample) are examples of Neville/Stanly types. The size and shape variability of this assemblage is somewhat less than that seen in the assemblage from Segment C. Some of the specimens (Figure 78q-t) are better classed as drills rather than points, but still show the characteristic stem shape typical of Neville/Stanly varieties. Four examples of broken stems are also illustrated (Figure 78v-aa) and based on their configuration they are also probably derived from Neville points. Based on the presence of the Neville points, these occupations of Segment D probably date to the time period between 6500 and 5000 B.C.

In sum, three basic projectile point types are represented in the Middle Archaic assemblages from the West Water Street Site: Neville/Stanly, LeCroy bifurcate, and triangular points (Table 46). All three types are clearly associated with Middle Archaic components at other sites in Eastern North America. The associated radiocarbon dates for all of these point types overlap in time to some extent (Figure 75); however, the date range for bifurcate and early triangular points does not extend after 5500 B.C. while that of Neville/Stanly forms does. Bifurcate and triangular points were the only point types found in Segment A and these types were not found in any other segments. Therefore, it is possible that the occupations in Segment A are slightly older than those in the other segments.

Radiocarbon Dates. No features or hearths were encountered in the Middle Archaic component of the West Water Street Site; therefore, there were no conventional sources of charcoal or other organic material for radiocarbon dating. However, two samples of charcoal were extracted from extensive flotation of the organic-rich paleosols in Segments B and C. This charcoal was not suitable for paleo-botanical analysis and was submitted to Beta Analytic, Inc. for dating. The sample from Segment C was too small for dating, after pretreatment. No samples suitable for any kind of radiocarbon dating were recovered from Segments A and D.

The sample from Segment B was large enough to date and returned a date of 7390 ± 110 B.P. (Beta-63528). The calibrated range (Stuiver and Reimer 1986) for this date is 6213 - 6181 B.C. with an intercept value of 6206 B.C. Tables 47 and 48 list calibrated and uncalibrated Middle Archaic dates from various sites and the date from West Water Street fits well within the early part of that range. The date also matches well with dates for Neville points from the type-site in New Hampshire (Dincauze 1976) noted in Table 47 and Figure 75. Therefore, the ca. 6200 B.C. date from Segment B can be viewed as a valid date for the Middle Archaic component of that segment.

TABLE 47
Calibrated Middle Archaic Radiocarbon Dates

Uncalibrated Date (BP)	Lab number	Calibrated Range (BC)	Point type	Site	Reference
7320±125	I-6600	6371-6003	Kirk-like	Harry's Farm	Kraft 1975:164
7380±120	I-6133	6400-6090	Kirk-like	Harry's Farm	Kraft 1975:164
4980±110	I-6599	3950-3690	Kittatinny	Harry's Farm	Kraft 1975:164
7520±120	I-8315	6460-6181	Kirk-like	Rockelein	Dumont and Dumont 1979:146
5280±110	I-7748	4240-3990	Stark-like	Rockelein	Kraft 1975:164
7880±145	DIC-474	7040-6503	Kanahwa, Kirk Stem	Russ	Funk and Wellman 1984:91
7960±215	DIC-473	7015-6817	Kanahwa, Kirk Stem	Russ	Funk and Wellman 1984:91
6960±215	DIC-752	6076-5630	Kirk-like	Russ	Funk and Wellman 1984:91
5630±115	DIC-352	4663-4360	Brewerton Side-Notch	Zawatski	Calkin and Miller 1977:310-312
5580±225	DIC-354	4720-4169	Kirk (?)	Zawatski	Calkin and Miller 1977:310-312
5660± 75	DIC-356	4660-4405	Side-Notched	Zawatski	Calkin and Miller 1977:310-312
6290±190	DIC-218	5471-5006	Otter Creek	Shafer	Wellman and Hartgen 1975
5670± 80	DIC-208	4665-4407	Brewerton Eared-Notch	Sylvan Lake	Funk 1976
6560±100	Y-1655	5560-5380	Neville	Sylvan Lake	Funk 1976
5980±120	I-2599	5054-4780	Otter Creek	Sylvan Lake	Funk 1976
6825±325	GX-11447	6035-5425	Neville, Kirk Stem	Muddy Brook RS	Tompkins and DiMaria1979
7260±125	I-4512	6214-5980	Kirk Stem, Kanahwa, LeCroy	Ward's Point	Ritchie and Funk 1971
7260±140	I-4070	6219-5980	Stanly, LeCroy, Kirk Notched	Old Place	Ritchie and Funk 1971
7980±150	DIC-1060	7024-6825	Hunterbrook Triangle	Turkey Swamp	Cavallo 1981
7950±110	DIC-1057	7060-6670	Hunterbrook Triangle	Turkey Swamp	Cavallo 1981
7820±215	DIC-1061	7050-6440	Hunterbrook Triangle	Turkey Swamp	Cavallo 1981
7660±325	DIC-1058	7027-6150	Hunterbrook Triangle	Turkey Swamp	Cavallo 1981
5570±200	I-5237	4674-4240	Vosburg	Faucett	Kinsey 1975
5180±200	Y-2479	4240-3780	Brewerton Eared-Notch	Faucett	Kinsey 1975
7740±280	GX-1746	7040-6238	Neville	Neville	Dincauze 1976
7650±400	GX-1747	7050-6090	Neville	Neville	Dincauze 1976
7210±140	GX-1922	6170-5960	Neville	Neville	Dincauze 1976
7015±160	GX-1449	6076-5720	Neville	Neville	Dincauze 1976
6060±130	GX-1921	5210-4802	Merrimack	Neville	Dincauze 1976
5910±180	GX-1748	5048-4585	Merrimack	Neville	Dincauze 1976
7425±200	UGA-1111	6450-6080	Bifurcate	State Road Ripple	Cowan 1991
7045±195	UGA-1109	6090-5669	Bifurcate	State Road Ripple	Cowan 1991
6915±100	UGA-877	5955-5650	Bifurcate	State Road Ripple	Cowan 1991
5210± 70	BETA-40026	4216-3978	Brewerton Side-Notch	Zawatski	Cowan 1991
5280±170	RL-1879	4340-3828	Brewerton Side-Notch	Brown	Cowan 1991; George and Davis 1986
6490±300	RL-1261	5640-5210	Stanly	Spruce Run	Cowan 1991
6390±750	CWR-155	5480-5230	Stemmed Types I, E, D	Piney Island	Kent 1970; Herbstritt 1988
5310±250	CWR-149	4340-3990	Stemmed Types I, E, D	Piney Island	Kent 1970; Herbstritt 1988
5383±250	C-367	4470-3970	Lamoka	Lamoka Lake	Funk 1976
5434±350	---	4712-3823	Halifax	Gaston	Coe 1964:99

TABLE 48
Uncalibrated Middle Archaic Radiocarbon Dates

Uncalibrated Date (BP)	Lab Number	Uncalibrated Date (BC)	Point type	Site	Reference
9380±100	DIC-261	7530-7330	Bifurcate	Gardepe	Funk and Wellman 1984:91
8220±470	DIC-475	6740-5800	Kanahwa, Kirk Stem	Russ	Funk and Wellman 1984:91
8585±190	GX-8225	6825-6445	Kirk Stem	Johnsen No. 3	Funk and Wellman 1984:91
8830±210	GX-8223	7090-6770	Kirk Stem	Johnsen No. 3	Funk and Wellman 1984:91
8880±255	GX-8205	7185-6675	Kirk Stem	Johnsen No. 3	Funk and Wellman 1984:91
9140±260	GX-8204	7190-6670	Kirk Stem	Johnsen No. 3	Funk and Wellman 1984:91
8250±140	I-5331	6440-6160	Kirk Stem, Kanahwa, LeCroy	Ward's Point	Ritchie and Funk 1971
8739±165	DIC-1059	6954-6624	Hunterbrook Triangle	Turkey Swamp	Cavallo 1981
8830±700	---	7580-6180	St. Albans	St. Albans	Broyles 1971
8820±500	---	7370-6370	St. Albans	St. Albans	Broyles 1971
8250±100	---	6400-6200	LeCroy	St. Albans	Broyles 1971
8160±100	---	6310-6110	Kanahwa	St. Albans	Broyles 1971

Analysis of Artifact Spatial Distributions

The excavations of the Middle Archaic component of the West Water Street Site were focused on exposing contiguous excavation blocks in order to study the spatial distributions of artifacts. An important goal of the spatial analyses was to understand the size and number of Middle Archaic occupations that were present. We specifically sought to determine if the Middle Archaic occupation consisted of a single occupation by a large social group or a series of small occupations by numerous different groups.

It is very difficult to determine the contemporaneity of the varied occupations, but it is possible to determine some attributes of the occupations. If there was a large macro-band base camp occupation at the site, there should be distinctive habitation, processing, and tool production areas. Furthermore, these areas should be rather large and there should not be multiple occurrences of similar activity areas within the individual excavation blocks. Examples of this kind of activity area distribution would include the large Late Archaic - Early Woodland living areas exposed at sites in northern Delaware (e.g. Custer 1989:198-204; Custer and Silber n.d.). In contrast, individual social group occupations should show compact and discrete distributions of combinations of activity areas. If the individual occupations are based on small family groups, then the artifact concentrations should be small enough to have several examples exposed in each individual excavation block. Examples of these smaller habitations areas would include Middle Archaic occupations at the Abbott Farm Site (Stewart and Cavallo 1991), Paleo-Indian occupations at the Thunderbird Site (Verrey 1986), Early Archaic activity areas at the Fifty Site (Carr 1986), and Late Archaic activity areas at the Hawthorn Site (Custer and Bachman 1982). In general, smaller habitation areas are more common at pre-Late Archaic sites and larger habitations areas are more common at Late Archaic and younger sites. One way to state part of the Middle Archaic research design is that we sought to determine if the West Water Street occupation was more like earlier Paleo-Indian/Early Archaic sites or later Late Archaic occupations.

Before considering the spatial distributions of artifacts, it is important to make some preliminary comments on the stone tool assemblages found in each segment. A more detailed commentary on technological aspects of the assemblages is presented later in the report; however, the types of tools present provide information on the nature of the occupations relevant to consideration of spatial distributions of artifacts. Tables 49-52 show summary catalogs of Middle Archaic artifacts from each segment and Table 53 shows counts of Middle Archaic tool types for each segment. The critical data in these tables are the wide range of tool types and general artifact types that are present in all segments. This wide range of tool types and artifact types suggests base camp habitation occupations rather than special function occupations. No features of any kind were

TABLE 49
Summary Catalog - Middle Archaic Occupation, Segment A

Tool Type	Chert	Jasper	Quartz	Rhyolite	Argillite	Other	Total
	Raw Material						
Projectile Points	---	4	---	---	---	---	4
Primary Cores	1	---	---	---	---	---	1
Secondary Cores	---	---	---	---	---	---	0
Late Stage Birfaces	---	---	---	---	---	---	0
Early Stage Bifaces	1	---	---	---	---	---	1
Biface Fragments	1	1	---	---	---	---	2
Flake Tools	10	6	1	---	---	---	17
Utilized Flakes	32	18	---	2	---	---	52
Flakes	238(1)	122(0)	2(0)	48(0)	21(0)	27(3)	458
Total	**283(1)**	**151(0)**	**3(0)**	**50(0)**	**21(0)**	**27(3)**	**535(4)**

(#) - Flakes with cortex

TABLE 50
Summary Catalog - Middle Archaic Occupation, Segment B

Tool Type	Chert	Jasper	Quartz	Rhyolite	Argillite	Other	Total
	Raw Materials						
Projectile Points	3	2	---	1	---	---	6
Primary Cores	13	2	---	---	---	---	15
Secondary Cores	---	1	---	---	---	---	1
Late Stage Birfaces	6	3	---	---	---	---	9
Early Stage Bifaces	4	2	---	---	1	---	7
Biface Fragments	9	12	---	---	---	---	21
Flake Tools	34	3	---	---	---	---	37
Utilized Flakes	36	17	---	---	---	1	54
Flakes	2185(6)	770(2)	2(0)	50(0)	52(3)	240(16)	3299
Total	**2290(6)**	**812(2)**	**2(0)**	**51(0)**	**53(3)**	**241(16)**	**3449(27)**

(#) - Flakes with cortex

TABLE 51
Summary Catalog - Middle Archaic Occupation, Segment C

Tool Type	Chert	Jasper	Quartz	Rhyolite	Argillite	Other	Total
	Raw Material						
Projectile Points	9	2	---	---	---	---	11
Primary Cores	16	---	---	---	---	---	16
Secondary Cores	2	1	---	---	---	1	4
Late Stage Birfaces	4	---	---	2	---	---	6
Early Stage Bifaces	3	1	---	---	1	1	6
Biface Fragments	6	2	---	---	---	---	9
Flake Tools	25	4	1	1	---	---	30
Utilized Flakes	26	5	---	---	---	---	31
Flakes	1975(4)	143(2)	26(2)	81(0)	19(0)	135(8)	2379
Total	**2066(4)**	**158(2)**	**27(2)**	**84(0)**	**20(0)**	**137(8)**	**2492(16)**

(#) - Flakes with cortex

TABLE 52
Summary Catalog - Middle Archaic Occupation, Segment D

Tool Type	Raw Material						
	Chert	Jasper	Quartz	Rhyolite	Argillite	Other	Total
Projectile Points	26	4	---	5	---	---	35
Primary Cores	15	---	1	---	---	---	16
Secondary Cores	1	---	---	---	---	---	1
Late Stage Birfaces	13	1	---	2	---	---	16
Early Stage Bifaces	11	2	---	2	---	1	16
Biface Fragments	12	2	---	2	---	---	16
Flake Tools	34	9	1	2	---	---	46
Utilized Flakes	101	16	3	6	---	1	127
Flakes	3614(8)	411(1)	37(5)	277(0)	231(0)	108(10)	4678
Total	**3827(8)**	**445(1)**	**42(5)**	**296(0)**	**231(0)**	**110(10)**	**4951(24)**

(#) - Flakes with cortex

TABLE 53
Middle Archaic Tool Types

Tool Type	Segment				
	A	B	C	D	Total
Points/Knives	4	6	11	35	56
LateStage Bifaces	0	9	6	16	31
Early Stage Bifaces	1	7	6	16	30
Drills	0	0	3	4	7
Concave/Biconcave Scrapers	3	8	3	5	19
Bifacial Side Scrapers	2	5	6	6	19
Unifacial Side Scrapers	2	7	3	6	18
Trianguloid End Scrapers	5	8	5	11	29
Slug-shaped Unifaces	0	0	1	0	1
Wedges	3	2	3	2	10
Primary Cores	1	15	16	16	48
Secondary Cores	0	1	4	2	7
Denticulates	1	4	4	7	16
Gravers	1	3	2	6	12
Regular Utilized Flakes	48	49	29	112	238
Blade-like Utilized Flakes	4	5	2	15	26
Total	**75**	**129**	**104**	**259**	**567**

identified, however. The absence of features means that the only data available on the spatial arrangements within the site are the artifact distributions.

<u>Segment A</u>. Figures 79-83 show a series of artifact distribution maps for the Middle Archaic occupation of Segment A. The map of the total artifact distribution (Figure 79) shows one major concentration in the northeast corner of the segment. Two more diffuse clusters are present in the central and western areas. The maps of debitage (Figure 80), jasper artifacts (Figure 81), and chert artifacts (Figure 82) show similar distributions because debitage is the most frequently occurring artifact class (Table 49), and because chert and jasper are the main lithic types present.

FIGURE 79

Middle Archaic: Segment A - All Artifacts

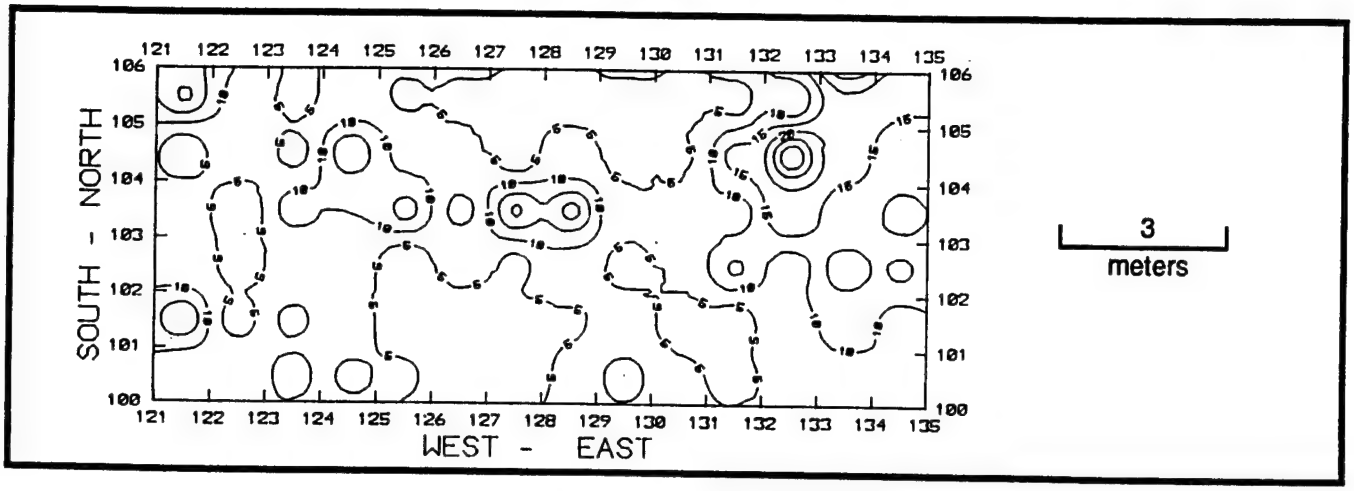


FIGURE 80

Middle Archaic: Segment A - Debitage

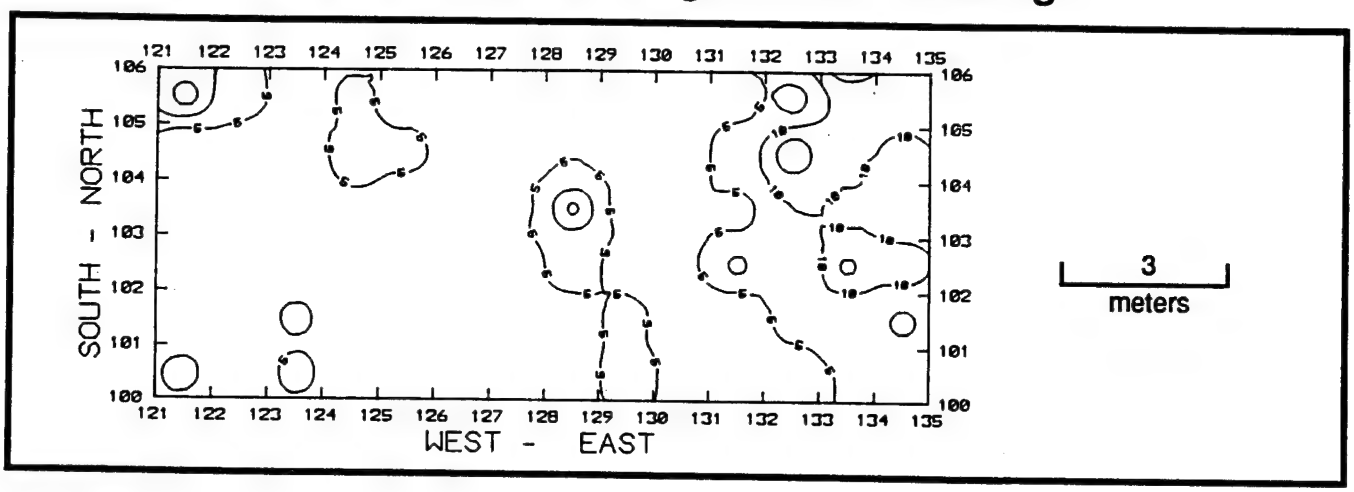


FIGURE 81

Middle Archaic: Segment A - Jasper Artifacts

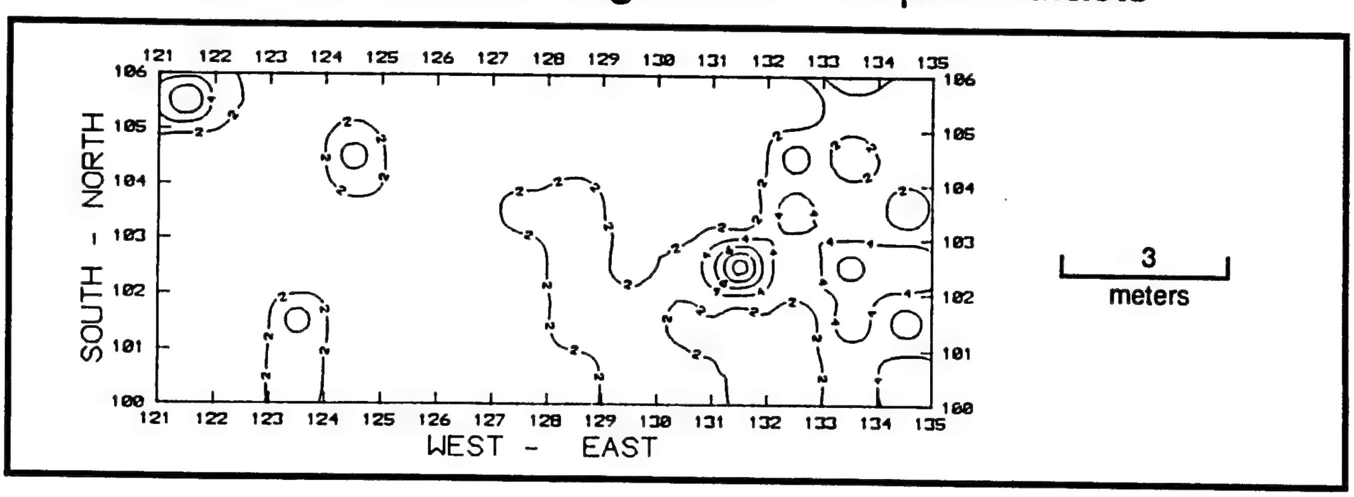


FIGURE 82
Middle Archaic: Segment A - Chert Artifacts

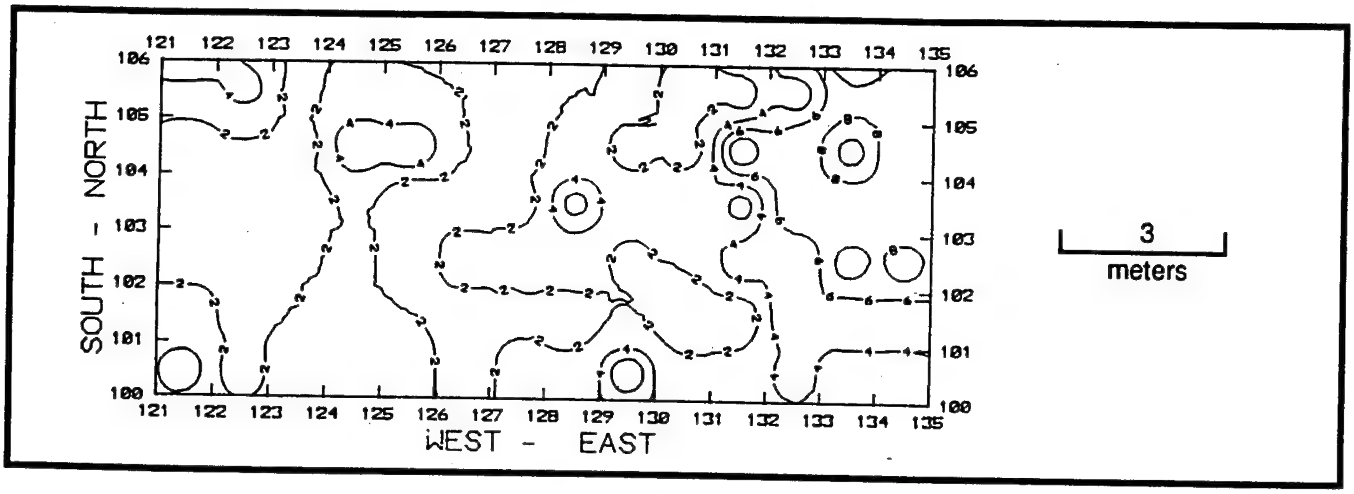


FIGURE 83
Middle Archaic: Segment A - Tools

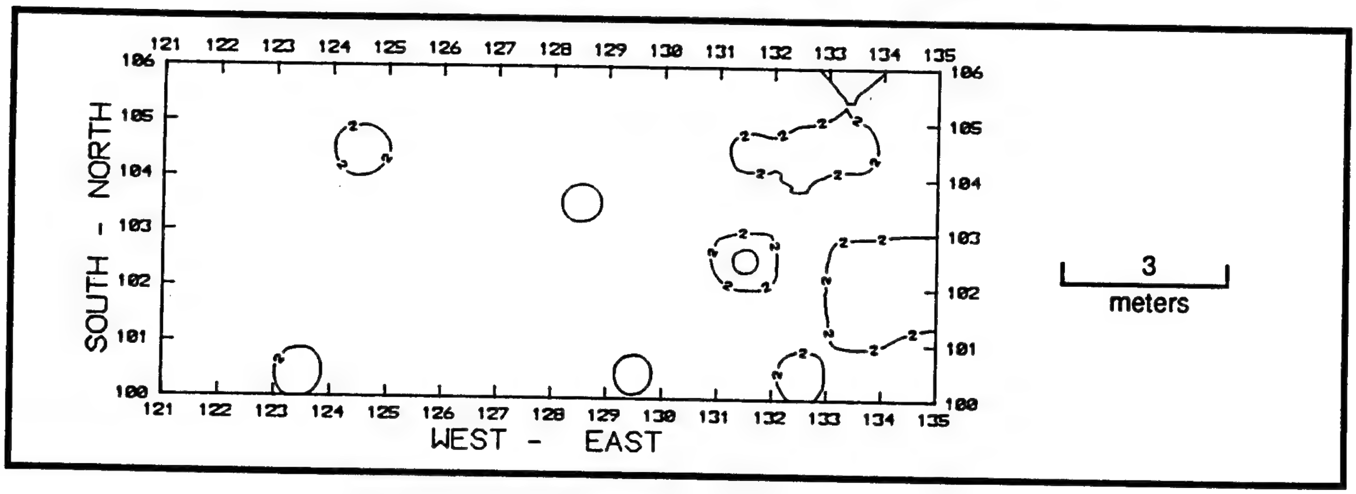


Figure 83 shows the distribution of tools. This distribution map is similar to the other maps for Segment A; however, more tools are associated with the eastern concentrations. Nevertheless, some tools are associated with the other concentrations. In sum, there are two, possibly three, occupations in this segment. The size and artifact composition of the clusters resemble those of individual family occupations.

Segment B. Distributions of artifacts in Segment B are shown in Figures 84-89. The total artifact distribution map (Figure 84) shows two clear concentrations on either end of the segment. Maps of debitage (Figure 85) and the various raw materials (Figures 86-88) show identical distributions because debitage is the major artifact class found in this segment's artifact assemblage (Table 50). The tool distribution map (Figure 89) also shows a similar pattern. In sum, two artifact concentrations are present in Segment B and they are consistent with individual family occupations.

FIGURE 84
Middle Archaic: Segment B - All Artifacts

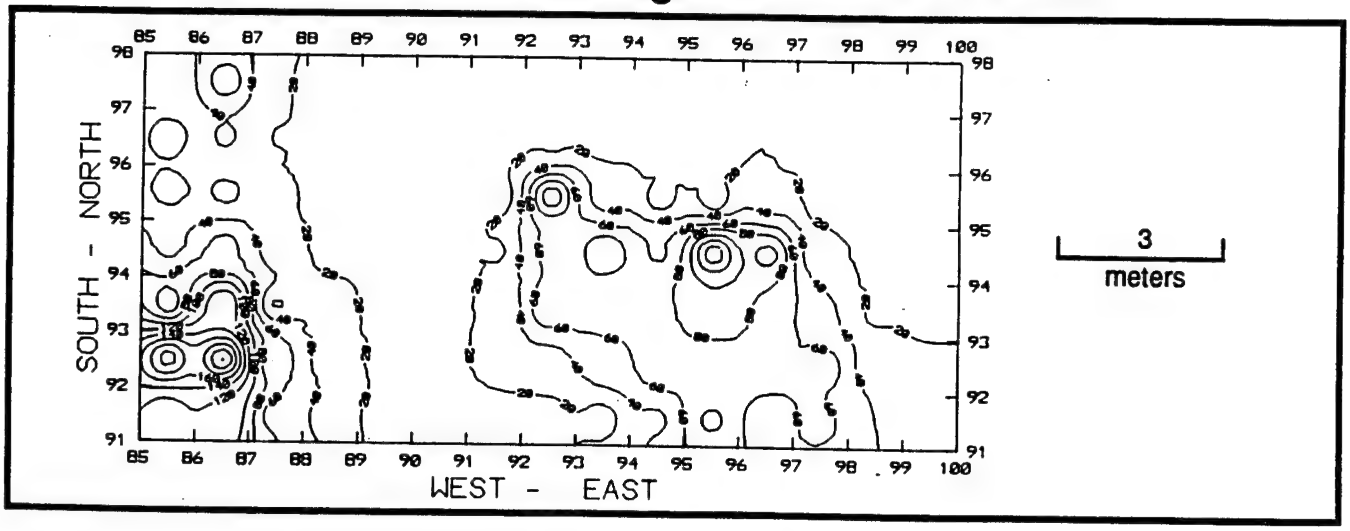


FIGURE 85
Middle Archaic: Segment B - Debitage

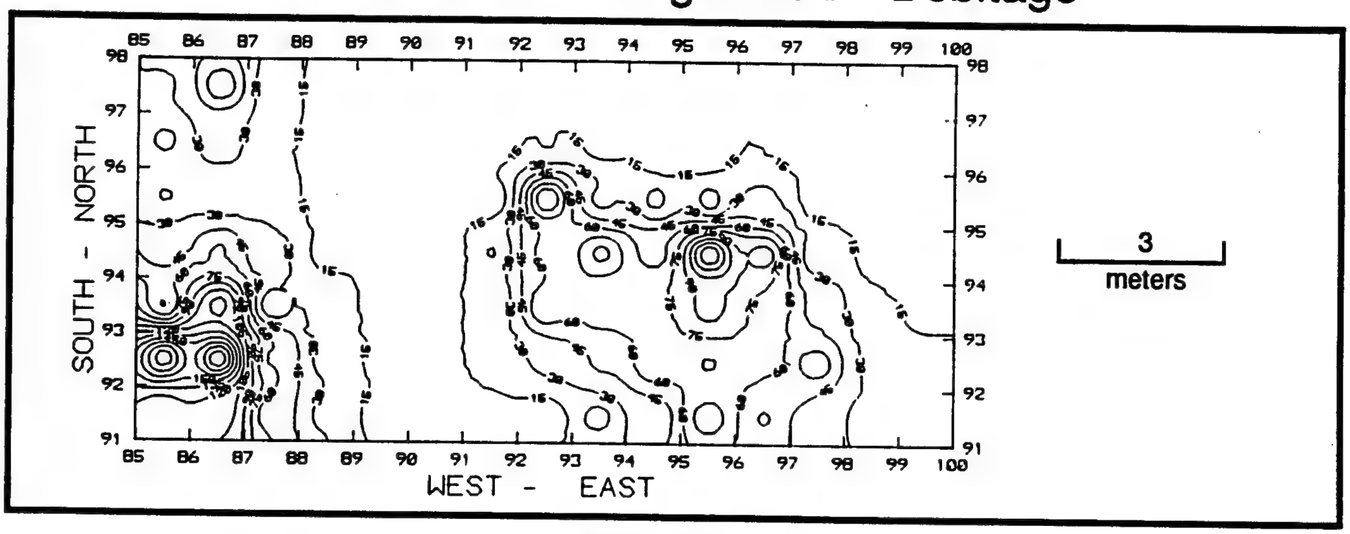


FIGURE 86
Middle Archaic: Segment B - Jasper Artifacts

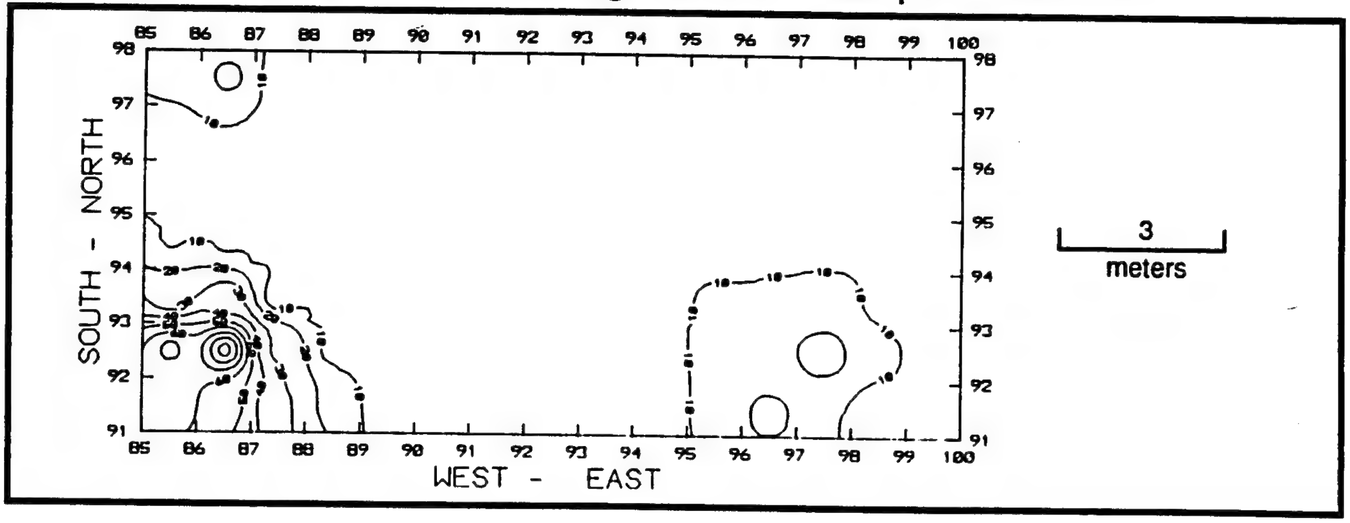


FIGURE 87

Middle Archaic: Segment B - Chert Artifacts

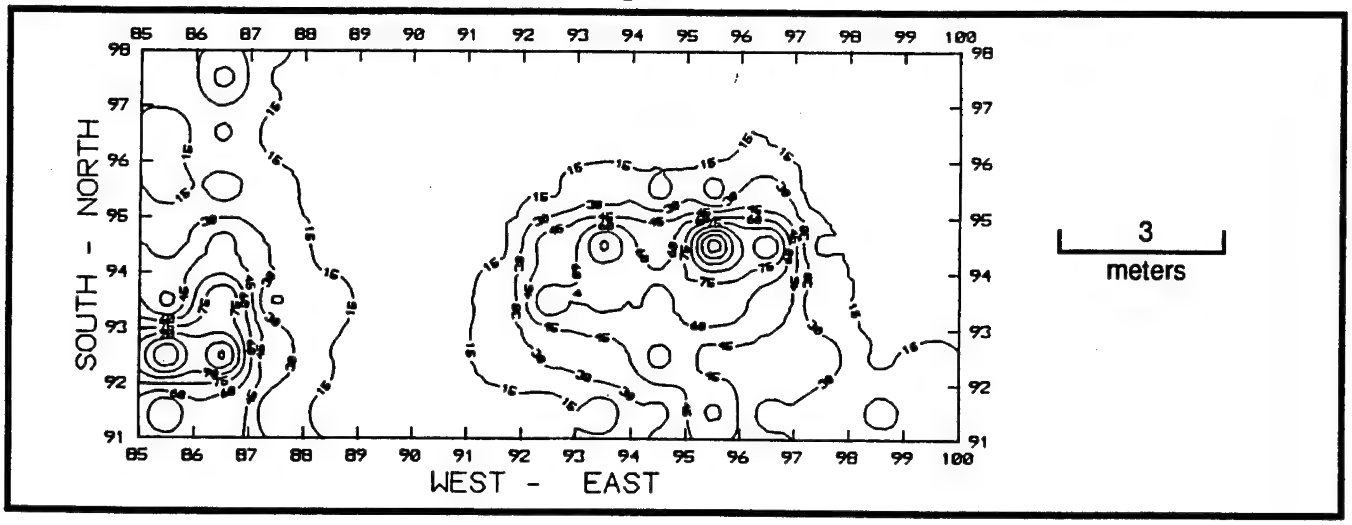


FIGURE 88

Middle Archaic: Segment B - Other/Quartzite Artifacts

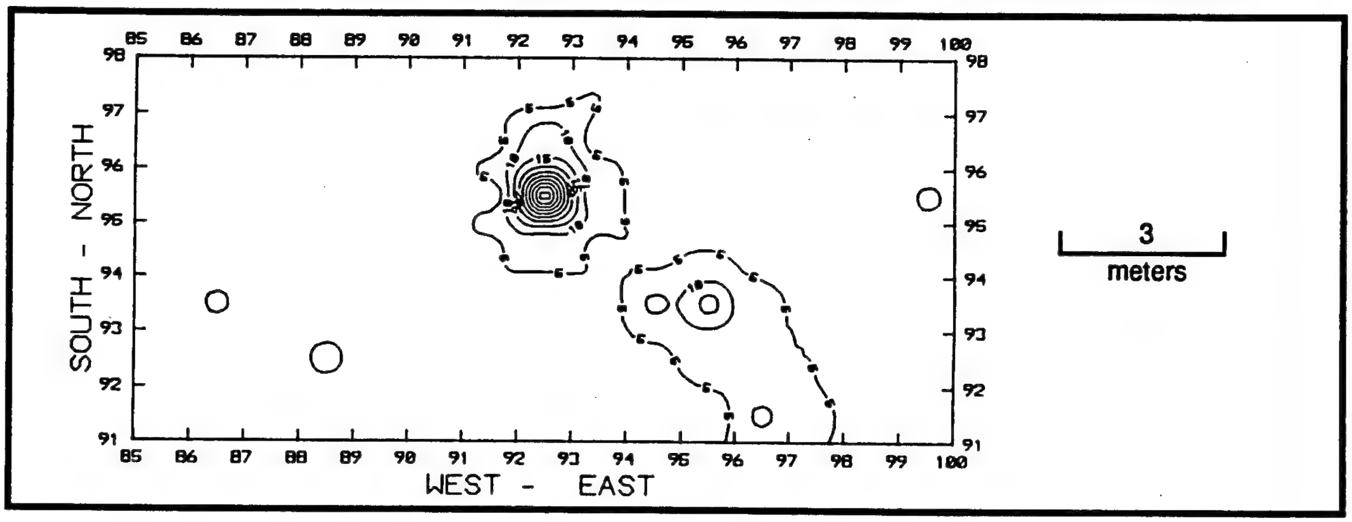


FIGURE 89

Middle Archaic: Segment B - Tools

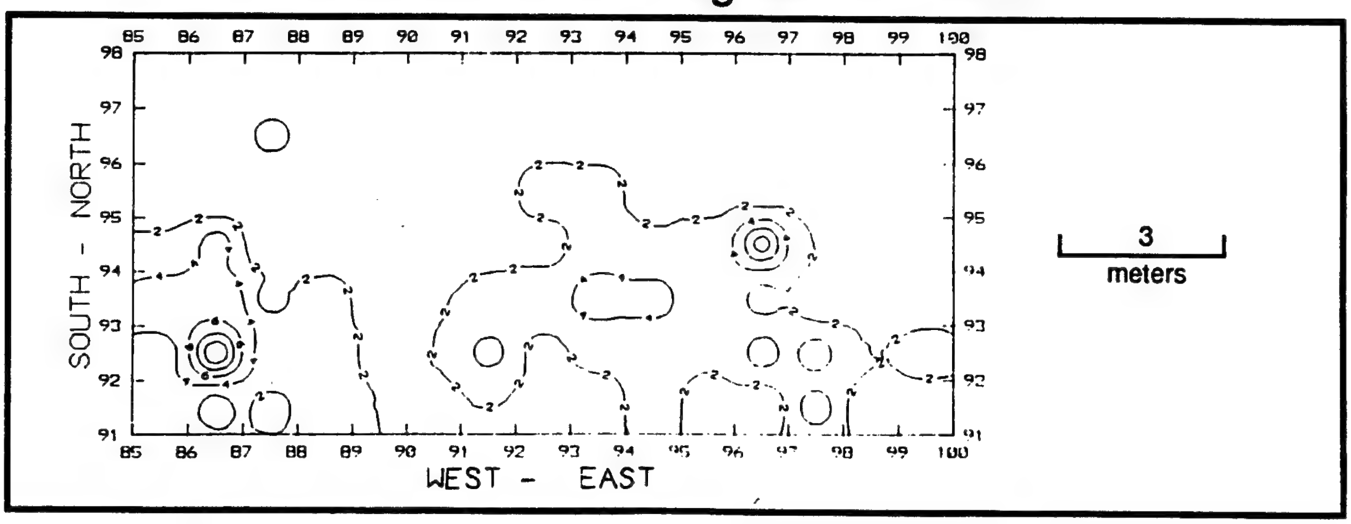


FIGURE 90
Middle Archaic: Segment C - All Artifacts

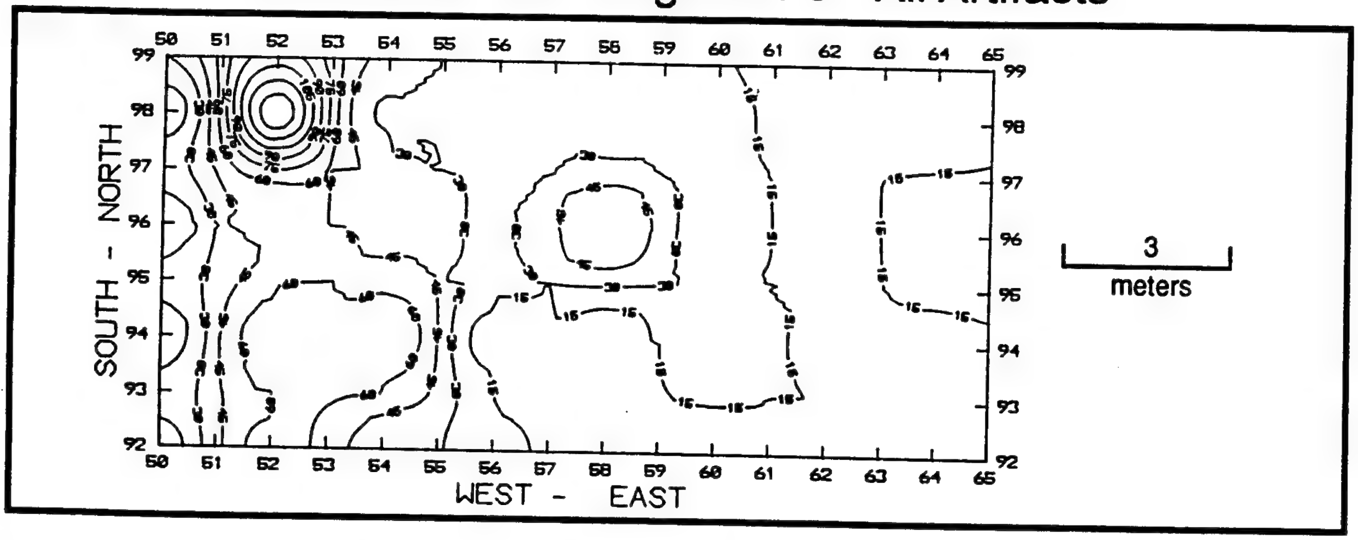


FIGURE 91
Middle Archaic: Segment C - Debitage

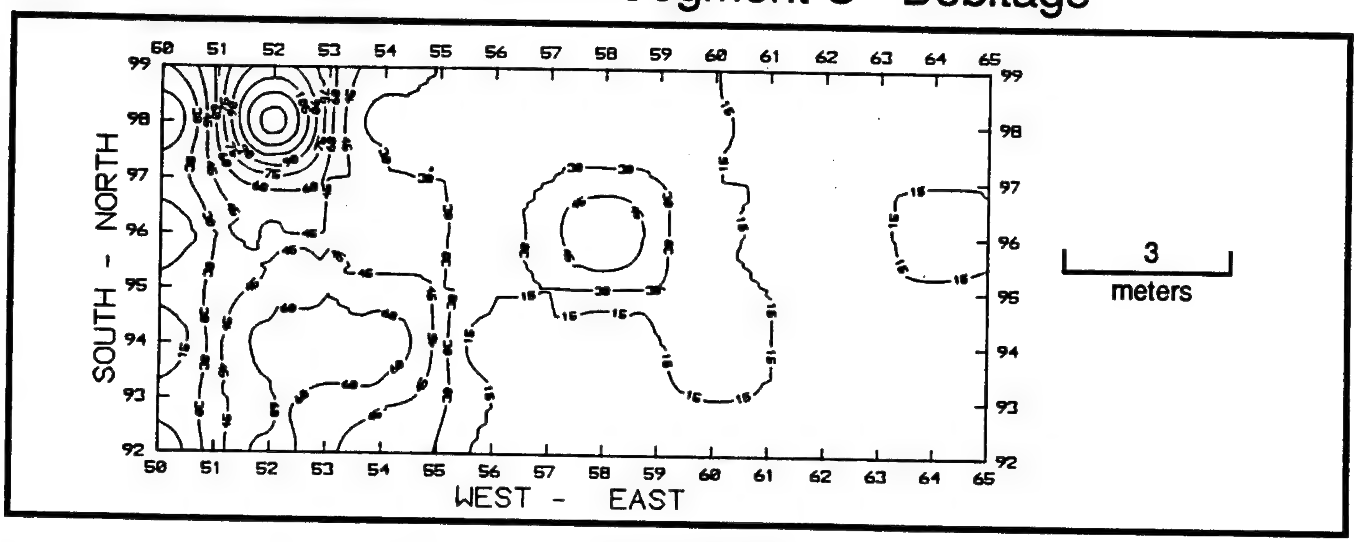


FIGURE 92
Middle Archaic: Segment C - Jasper Artifacts

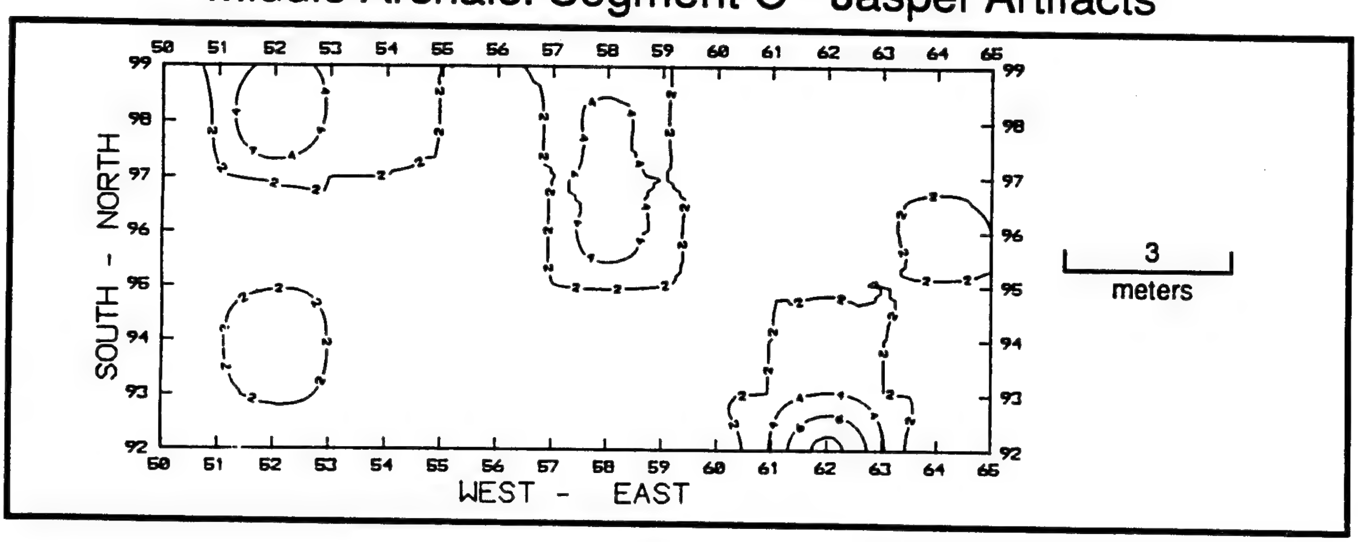


FIGURE 93
Middle Archaic: Segment C - Chert Artifacts

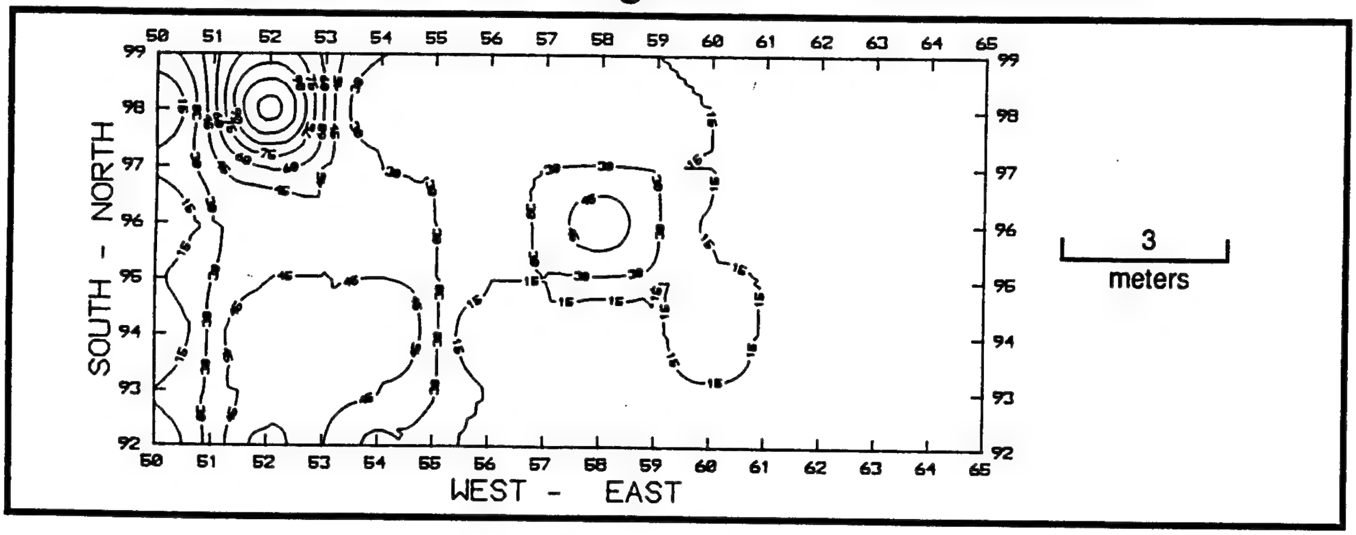


FIGURE 94
Middle Archaic: Segment C - Rhyolite Artifacts

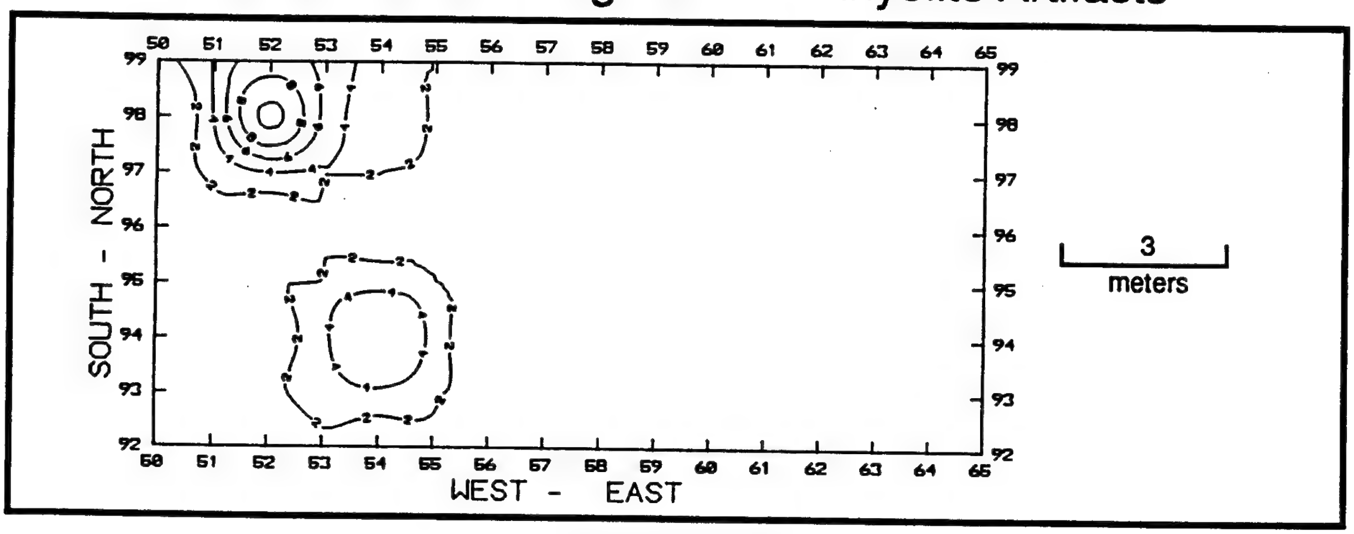
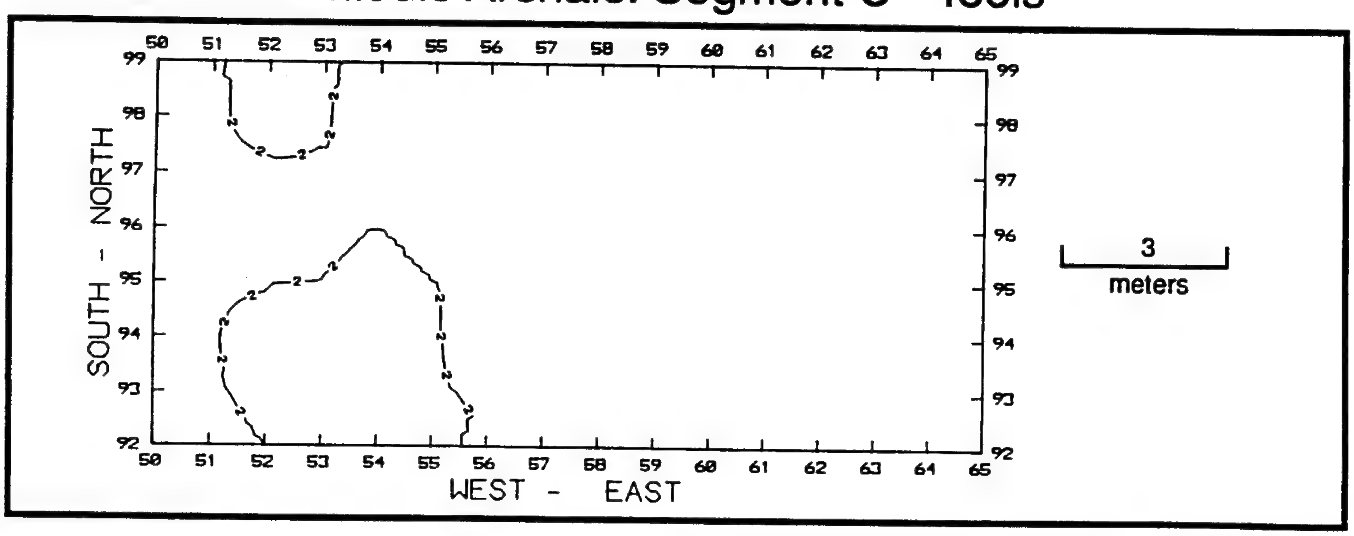


FIGURE 95
Middle Archaic: Segment C - Tools



Segment C. Figures 90-95 show artifact distributions within Segment C. The total artifact distribution map (Figure 90) shows an intensive clustering of artifacts within the northwestern corner of the segment. A more diffuse cluster is present in the center of the segment. Maps of debitage (Figure 91) and varied lithic raw materials (Figures 92-94) show similar distributions because debitage is the main artifact type in the assemblage (Table 51). Tools (Figure 95) show a similar distribution, but tend to be located on the edges of the main artifact concentration.

In sum, the artifact distribution maps show that there is one main cluster consistent with a family occupation in Segment C. The diffuse cluster in the central portion of the segment contains only cryptocrystalline debitage and may be a specialized lithic reduction area. This specialized activity area may be associated with the main habitation area based on its proximity to that area.

Segment D. Because Segment D is twice as large as the other segments, it was divided into eastern and western halves for analysis. Figures 96-102 show artifact distribution maps for the east half of the segment. The total artifact distribution map (Figure 96) shows three main artifact clusters and identical clustering is shown by the map of debitage (Figure 97) because debitage is the most common artifact type in the assemblage (Table 52). One cluster is located in the central section (Cluster 1) and the other two are located on the northern border of the segment half on its eastern (Cluster 2) and western (Cluster 3) margins. Jasper artifacts (Figure 98) are most clearly associated with Cluster 1; however, chert artifacts (Figure 99) are found in all three clusters. Rhyolite artifacts (Figure 100) are associated with Cluster 1 and argillite artifacts (Figure 101) are associated with Cluster 2. Tools are found in all three clusters (Figure 102) but are most numerous in Cluster 2.

The artifact clusters are again indicative of individual family occupations. Their size and artifact composition suggest separate occupations. The different raw materials in the clusters (Cluster 1 - chert, jasper, rhyolite; Cluster 2 - chert, jasper, argillite; Cluster 3 - chert, rhyolite) also support the contention that these are separate occupations.

Figures 103-109 show artifact distributions from the western half of Segment D. The map of total artifacts (Figure 103) shows two clusters in the eastern half of this portion of Segment D and these clusters overlap to some extent. As was the case with other segments, debitage is the most common artifact type (Table 52) and its distribution map (Figure 104) shows an identical pattern. Distributions of varied raw materials (Figures 105-108) and tools (Figure 109) show the same distribution. In sum, at least one, and probably two, separate small occupations are present in the western half of Segment D.

FIGURE 96
Middle Archaic: Segment D, East Half - All Artifacts

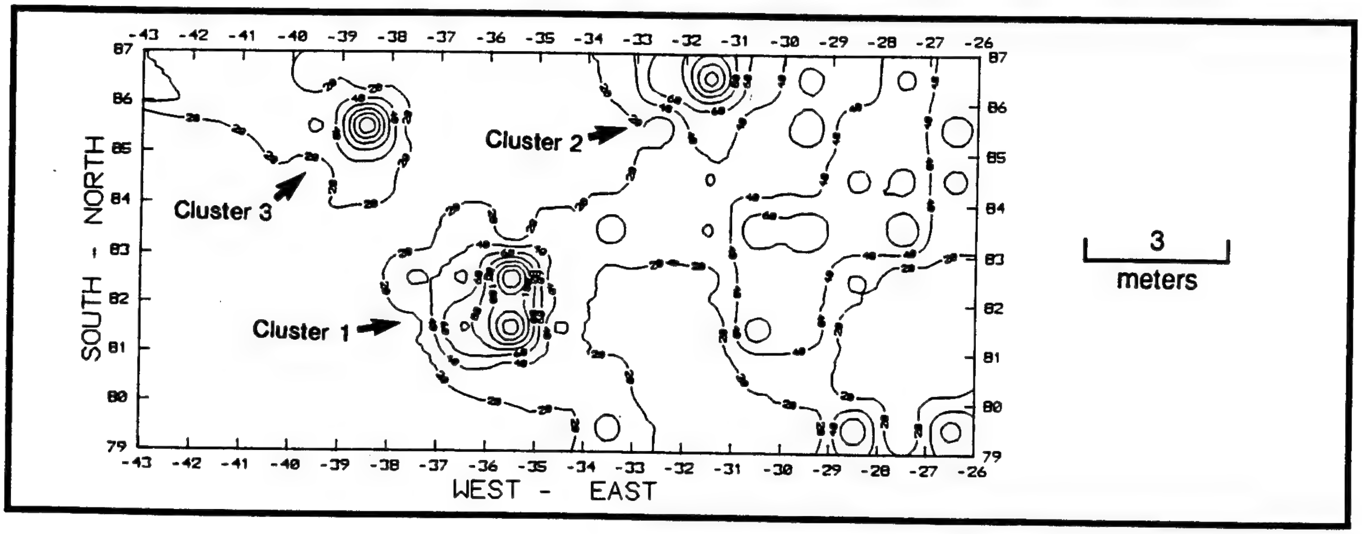


FIGURE 97
Middle Archaic: Segment D, East Half - Debitage

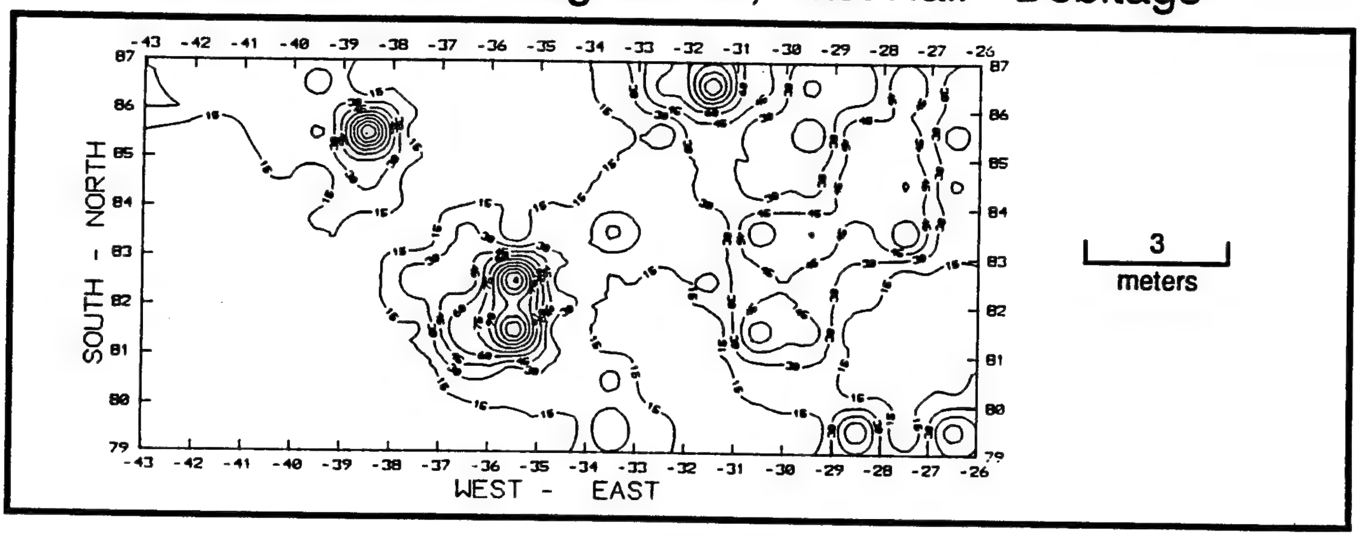


FIGURE 98
Middle Archaic: Segment D, East Half - Jasper Artifacts

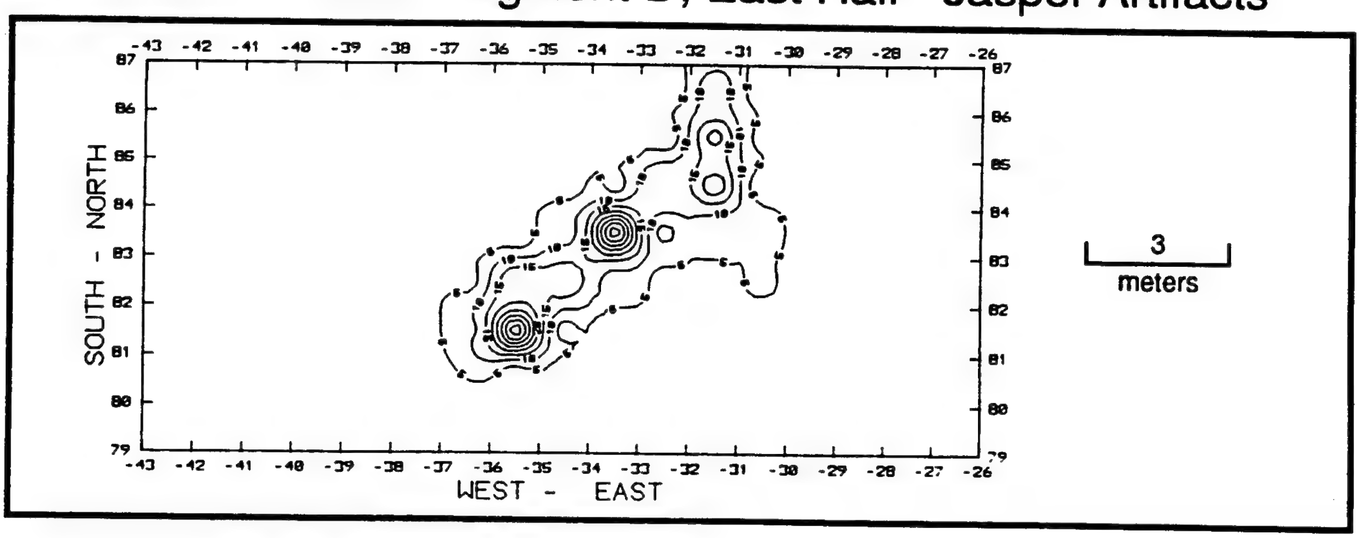


FIGURE 99
Middle Archaic: Segment D, East Half - Chert Artifacts

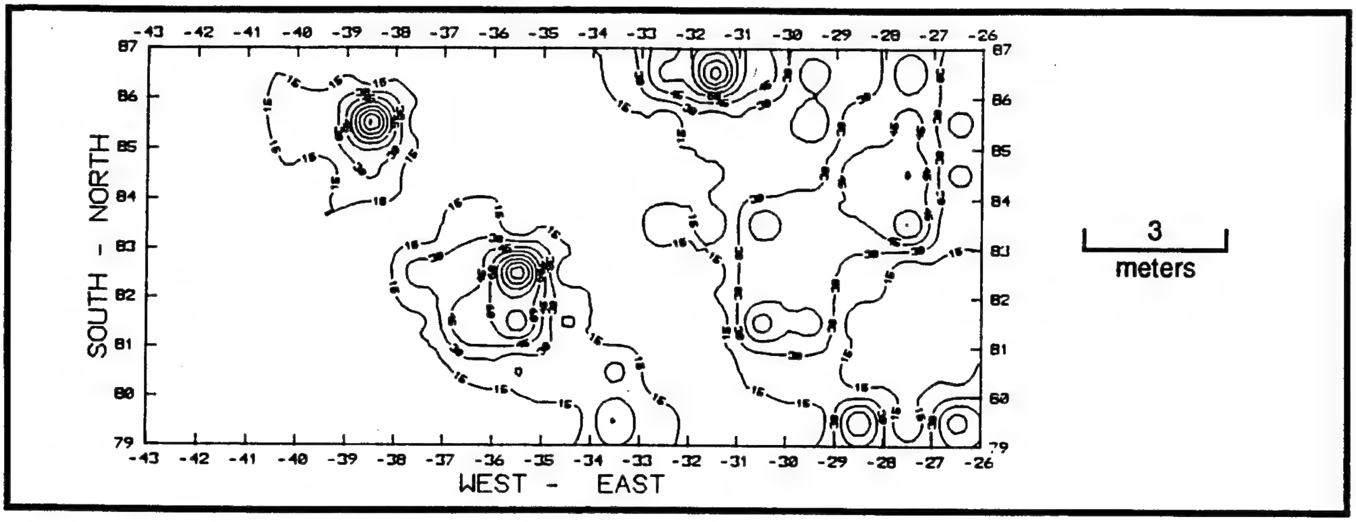


FIGURE 100
Middle Archaic: Segment D, East Half - Rhyolite Artifacts

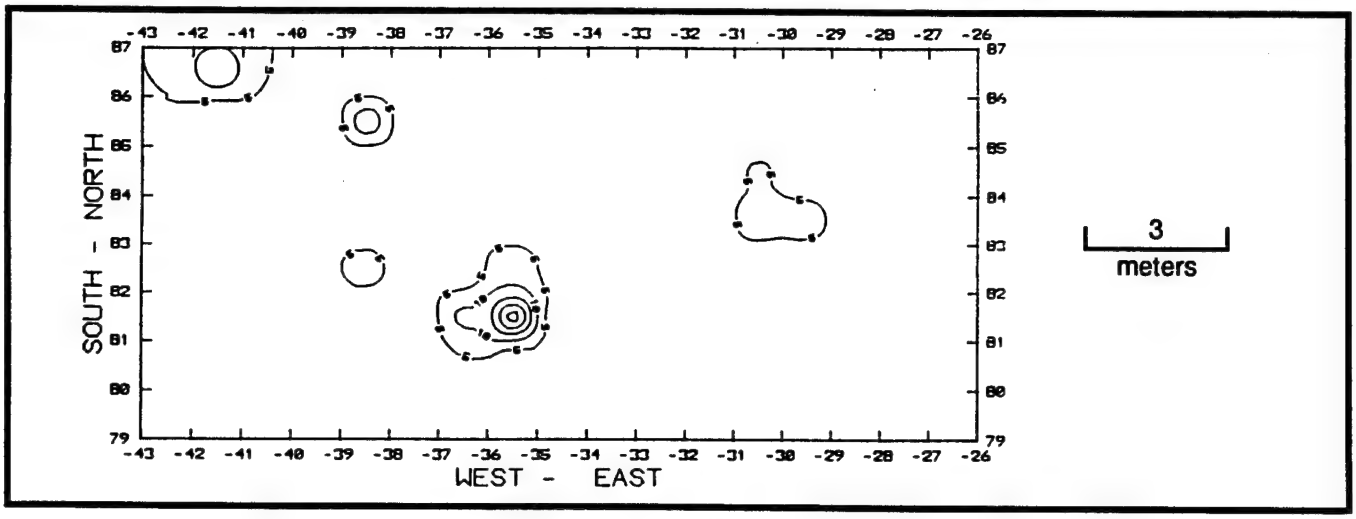


FIGURE 101
Middle Archaic: Segment D, East Half - Argillite Artifacts

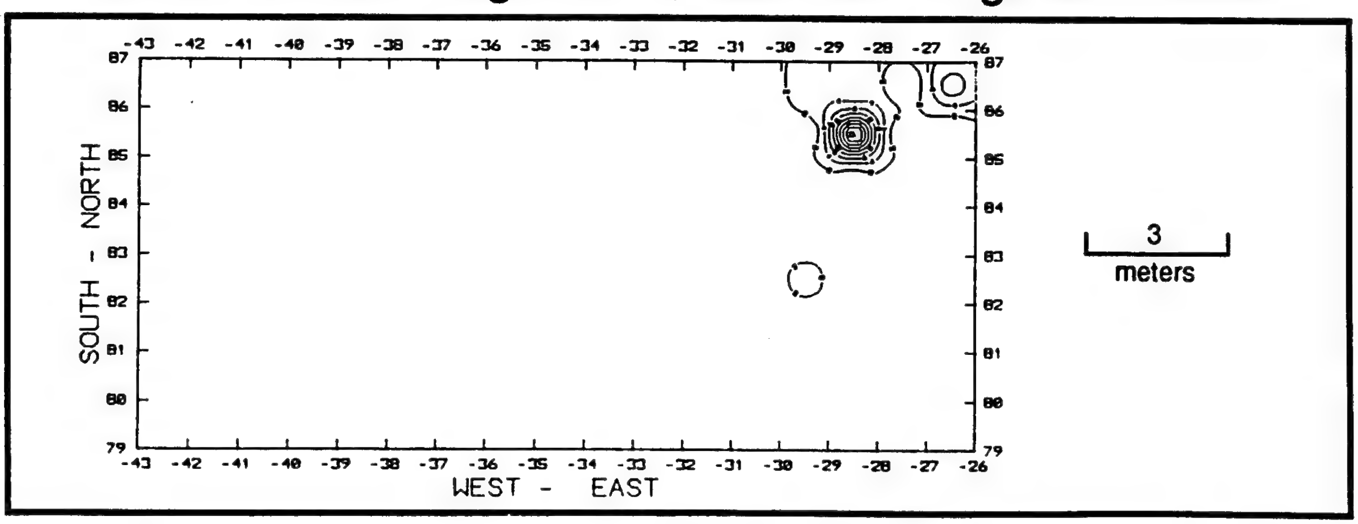


FIGURE 102
Middle Archaic: Segment D, East Half - Tools

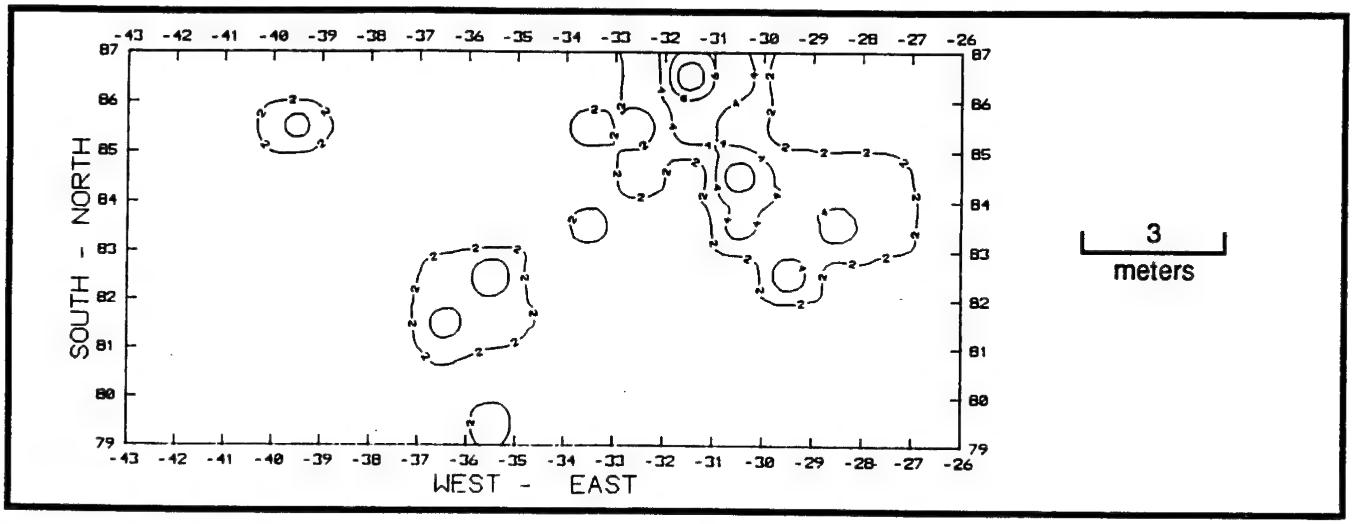


FIGURE 103
Middle Archaic: Segment D, West Half - All Artifacts

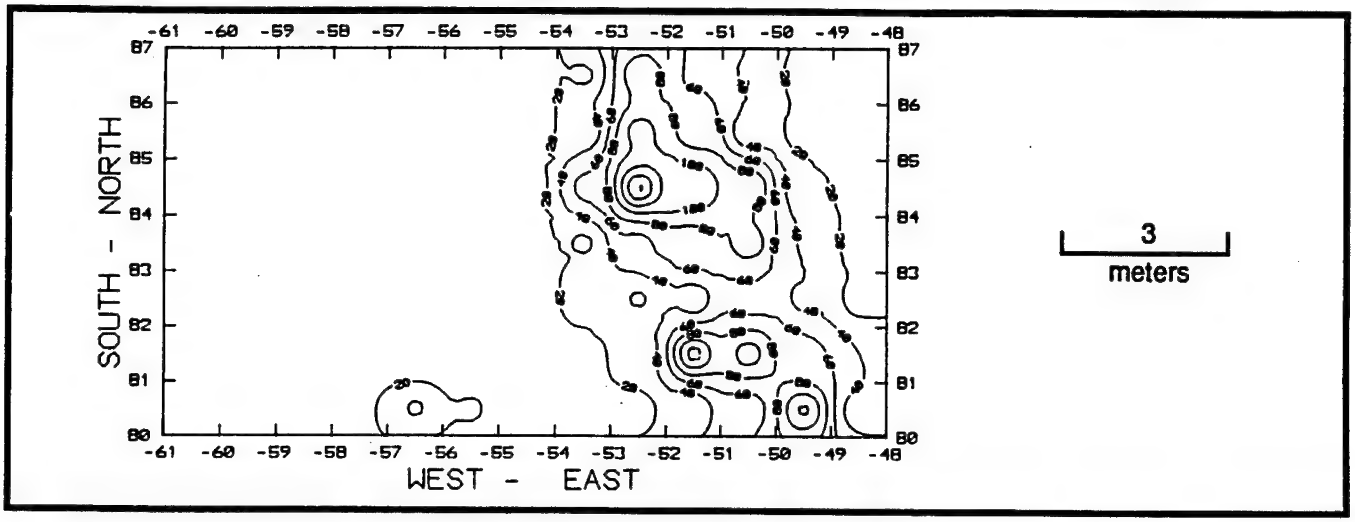


FIGURE 104
Middle Archaic: Segment D, West Half - Debitage

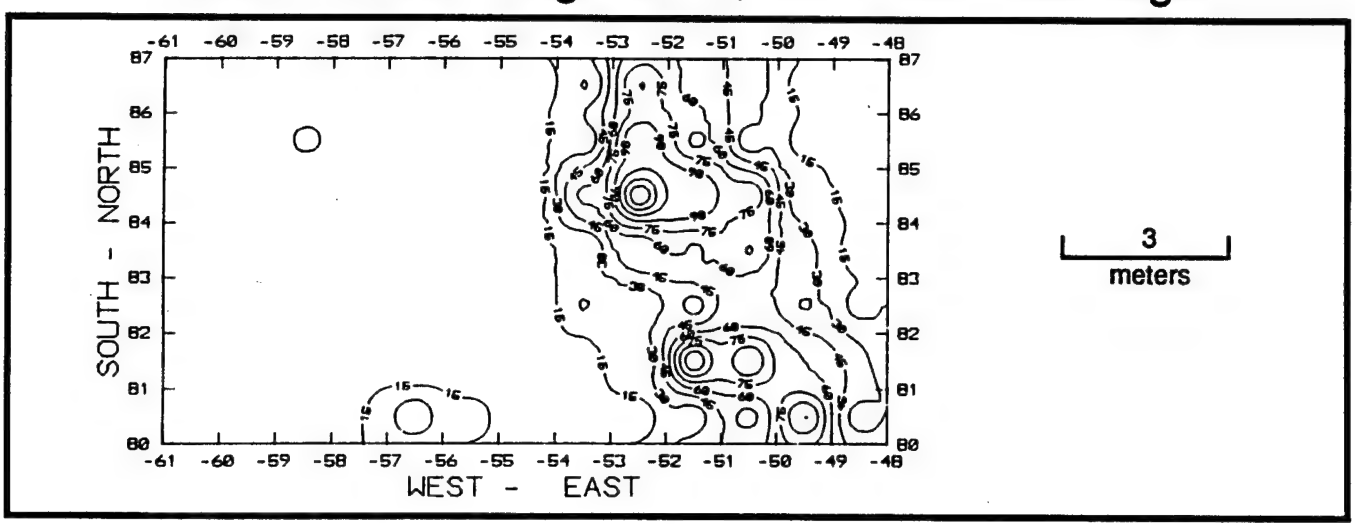


FIGURE 105
Middle Archaic: Segment D, West Half - Jasper Artifacts

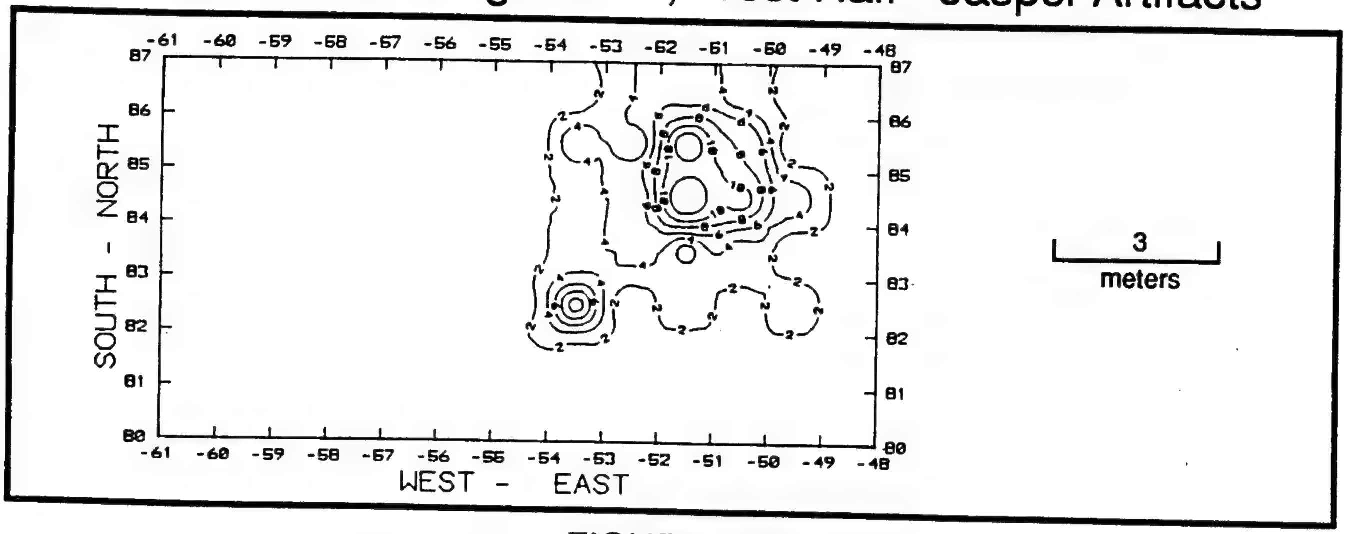


FIGURE 106
Middle Archaic: Segment D, West Half - Chert Artifacts

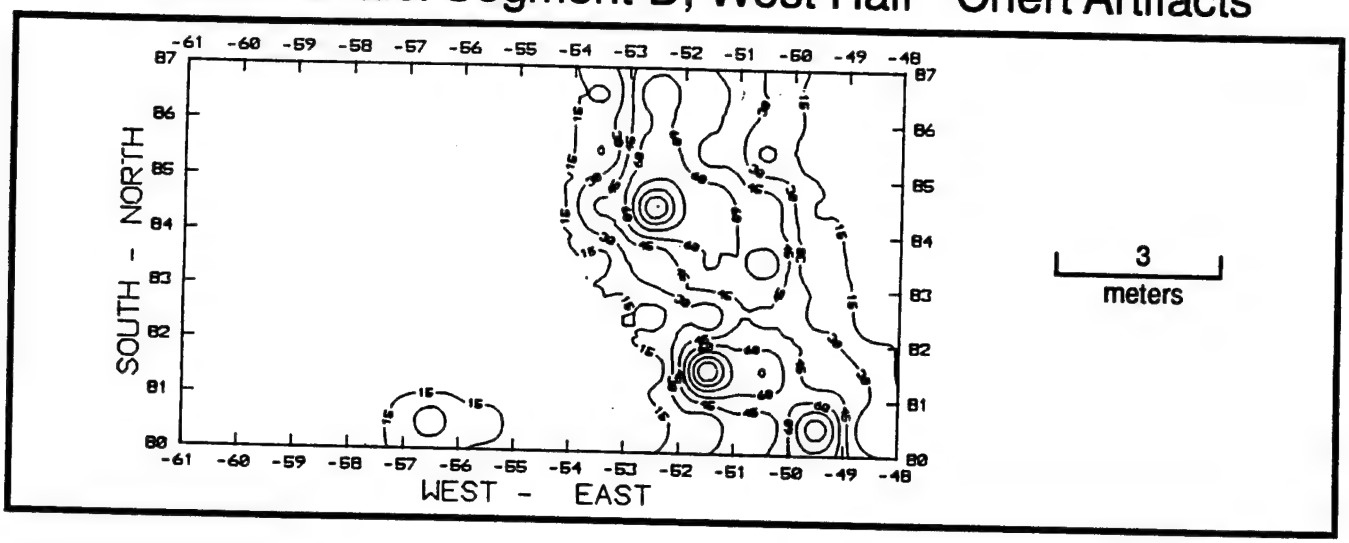


FIGURE 107
Middle Archaic: Segment D, West Half - Rhyolite Artifacts

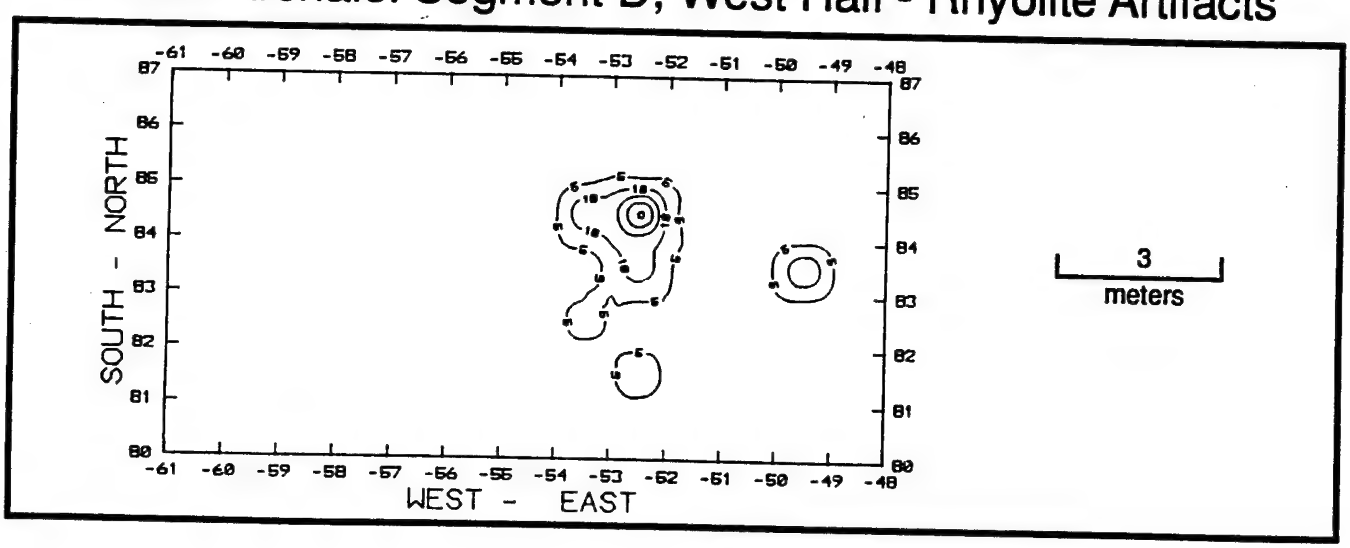


FIGURE 108

Middle Archaic: Segment D, West Half - Argillite Artifacts

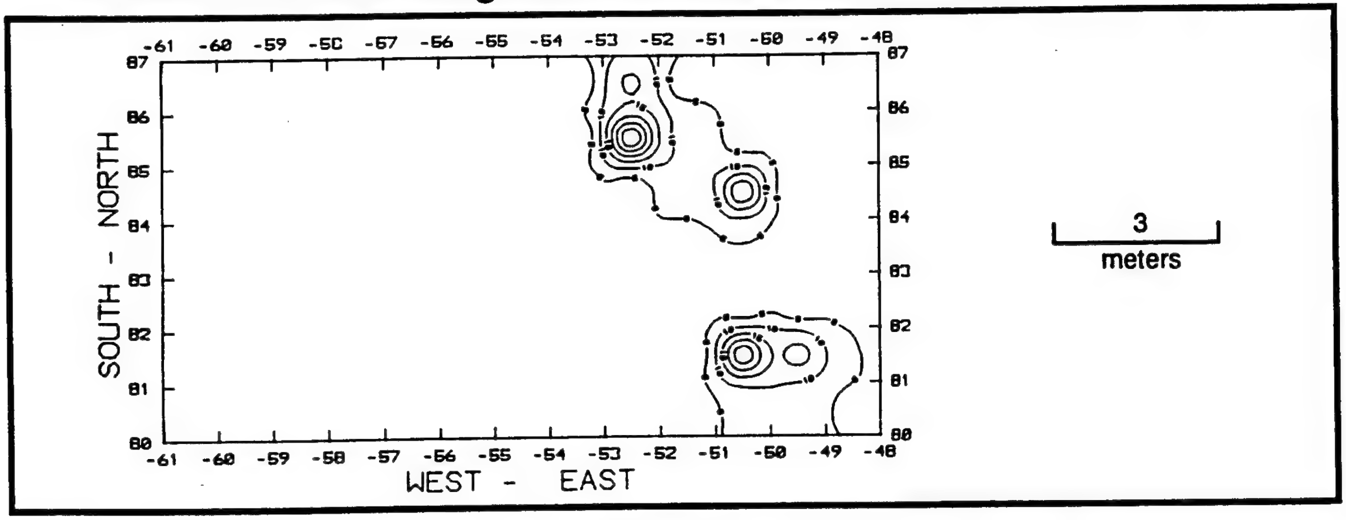
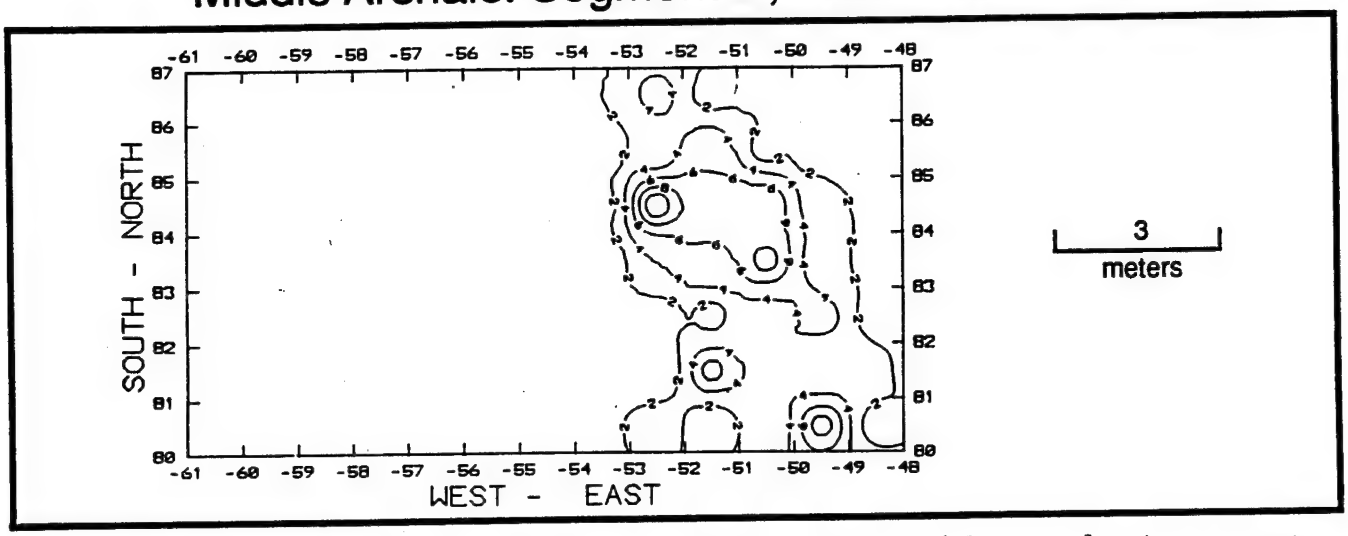


FIGURE 109

Middle Archaic: Segment D, West Half - Tools



Discussion. In all segments, the artifact clusters are rather small and generally contain all of the different artifact types. The redundancy of the artifact clusters would seem to suggest that they are all individual family habitation locales. In some cases there is variability in the types of lithic raw materials, but all clusters have locally available chert as the most commonly used raw materials (Tables 49-52).

The variability in what could be called "residual" lithic types among the spatial clusters may represent idiosyncratic lithic type preferences among the individual family groups. This variability may also reflect the lithic resources that were brought into the site in curated tool kits of individual groups. These lithic resources (argillite, jasper, and rhyolite) are available in different locations, and their presence in curated tool kits may reflect the range of territories that the Middle Archaic inhabitants of the West Water Street Site had just visited before they came to the Lock Haven area.

Rhyolite is found in south central Pennsylvania, jasper from areas in central Pennsylvania near Houserville and eastern Pennsylvania in Berks and Lehigh counties, and argillite in the Delaware Valley. The varied composition of the "residual" debitage assemblages among the clusters would imply that the Middle Archaic groups who are associated with the clusters had traveled through different territories. For example, in the east half of Segment D (Figure 96), Clusters 1 and 3 have a mix of chert and rhyolite which suggest a territory that extended south to the Blue Ridge physiographic province. In contrast, the presence of jasper and argillite suggest a territory that extended east into the Delaware River Valley. This variation in territories suggests that the clusters were produced by unrelated Middle Archaic groups who occupied the West Water Street Site on a serial basis.

Although the territory data noted above implies that the occupations were by individual groups who lived at the site on separate occasions, there is no way to know if these occupations occurred contemporaneously. Few of the clusters overlapped, and this observation implies that the occupations occurred over a short enough time interval so that each family group could avoid the debris deposited by earlier groups. However, there is no way to know if the time intervals involved are years or decades. Furthermore, the soils data noted earlier which suggested a "stable" landscape and "rapid" burial do not help to answer this question because the relevant time frame for these studies spans decades and centuries.

Ethnoarchaeological data provide some possible insights concerning the time frame represented by the West Water Street Middle Archaic occupation. Summary spatial distribution data on modern hunters and gatherers presented by Binford (1983: Chapter 7) and Yellen (1977) indicate that when multiple families of hunter-gatherers congregate at a single locale, they create sites with clustered family dwellings and distinctive work areas. The West Water Street Middle Archaic clusters definitely <u>do not</u> show such spatial organization and are much too small to be the result of multiple family settlements. Therefore, the occupations were unrelated to one another and did not occur contemporaneously.

Lithic Artifact Analysis

This section of the report describes the lithic artifact assemblage from the Middle Archaic occupation from a tool manufacturing and use perspective. The description is organized by the major tool types and focuses on the individual mapped segments (Segments A-C, Segment D-West Half, Segment D-East Half).

<u>Projectile Points</u>. The large sample of Middle Archaic projectile points allows a meaningful analysis of projectile point manufacture and use. Table 54 summarizes lithic raw material use among the Middle Archaic projectile points. Chert

TABLE 54
Raw Material Use for Middle Archaic Projectile Points

Area	Point Type	Raw Material Chert	Jasper	Rhyolite	Total
A	Bifurcate	0	3	0	3
	Triangular	0	1	0	1
	Unidentified	2	0	0	2
	Sub-total	2	4	0	6
B	Neville/Stanly	1	0	1	2
	Unidentified	2	1	0	3
	Sub-total	3	1	1	5
C	Neville/Stanly	9	2	0	11
D	Neville/Stanly*	25	4	5	34
	Unidentified	1	0	0	1
	Sub-total	26	4	5	35
Combined	Bifurcate	0	3	0	3
	Triangular	0	1	0	1
	Neville/Stanly	35	6	6	47
	Unidentified	5	1	0	6
	Total	**40**	**11**	**6**	**57**

*Includes stem fragments

is the most commonly used raw material and accounts for more than 70% of the projectile points. Jasper is the next most frequently used material (19%) and rhyolite accounts for slightly more than 10% of the assemblage. It is interesting to note that the bifurcate and triangular points are all manufactured from jasper. This different lithic raw material use compared to the rest of the assemblage underscores the notion that the Middle Archaic occupation of Segment A, where these points were found, is slightly older than the occupations of the other segments.

The use of rhyolite in this Middle Archaic assemblage is interesting. During the discussion of the Late Archaic component it was seen that extensive use of rhyolite characterizes that time period. Studies of the temporal distribution of rhyolite artifacts shows that rhyolite use first appeared during Early and Middle Archaic times in numerous areas (Stewart 1984, Kavanagh 1982, Custer 1989:117-119; 1990:35-40). Stewart (1984) suggests that Middle Archaic groups discovered rhyolite in the upland areas of the Blue Ridge when their settlement patterns changed and they began to regularly exploit these locales. The appearance of rhyolite in the Middle Archaic tool kits at the West Water Street Site suggests that these groups were ranging as far south as the rhyolite quarries, a distance of 100 km. Estimates of Middle Archaic territories are quite large (Custer 1990), and the distance from the Lock Haven area to the South Mountain rhyolite quarries would fall well within those territories.

Rhyolite usage during the Middle Archaic occupation differs from the Late Archaic pattern in that rhyolite is not the most commonly used lithic raw material during Middle Archaic times, as it was during Late Archaic times. The rhyolite Middle Archaic artifacts also show that the prehistoric flintknappers had

TABLE 55
Production, Fracture, and Reuse Attributes of Middle Archaic Projectile Points

Area	Point Type	Total	Flake Based	Impact Fracture	Transverse Fracture	Reworked-Drill	Reworked Scraper
A	Bifurcate	3	2	2	0	0	0
	Triangle	1	1	0	0	0	0
	Unidentified	2	1	1	0	0	0
	Sub-total	6	4	3	0	0	0
B	Neville/Stanly	2	0	0	0	0	0
	Unidentified	3	0	3	0	0	0
	Sub-total	5	0	3	0	0	0
C	Neville/Stanly	11	5	5	3	1	0
D	Neville/Stanly*	25	13	16	5	5	3
	Unidentified	1	0	0	0	0	1
	Sub-total	26	13	16	5	5	4
Combined	Bifurcate	3	2	2	0	0	0
	Triangular	1	1	0	0	0	0
	Neville/Stanly	38	18	21	8	6	3
	Unidentified	6	1	4	0	0	1
	Total	**48**	**22**	**27**	**8**	**6**	**4**

*Does not include stem fragments

trouble flaking the rhyolite to make projectile points. Large step and hinge fractures where flakes do not carry through to their termination points are common among the rhyolite artifacts (Figures 77e, 77m, and 78c). Modern flintknappers note that rhyolite is difficult to flake (Callahan 1979) and looking at some of the West Water Street rhyolite artifacts makes one wonder why the material was chosen for use.

Rhyolite projectile points also show some differences in reduction and manufacturing strategies. Numerous authors (Stewart and Cavallo 1991) have noted that many Middle Archaic projectile points are manufactured from flakes and 45% (Table 55) of the Middle Archaic projectile points from the West Water Street Site are indeed made from flakes (Figures 77b, 77c, 78e, and 78q). In contrast, none of the rhyolite points are made on flakes and are instead the result of formal biface reduction (Callahan 1979). This difference in percentages is statistically significant ($p<.05$) as indicated by application of a difference-of-proportion test. These differences in production techniques may indicate that the non-local rhyolite was reduced in different ways from cryptocrystalline materials. The differences in point production techniques among the different raw materials may be due to the fact that rhyolite was transported around the landscape as part of a curated technology while cryptocrystalline materials were used on a more expedient basis. More observations of Middle Archaic lithic raw material use from other sites is needed to further evaluate this hypothesis.

Fractures and reworking of the Middle Archaic projectile points from the West Water Street Site (Table 55) reveal that they were used for a variety of functions. Impact fractures

indicative of projectile point use (Ahler 1971) are quite common and are seen on 56% of the points (Figures 77a and 78a). This frequency of impact fractures is similar to that observed by Custer (1991:69) for narrow-blade stemmed projectile points of the Late Archaic-Middle Woodland Periods (45%) and Late Woodland triangular arrow points (55%). Application of the difference-of-proportion test shows no significant differences among the percentages. In contrast, impact fractures were present on only 6% of a large sample of Late Archaic broadspears (Custer 1991:69) and the differences between this percentage and the percentages for Middle Archaic, late Archaic narrow-blade stemmed points, and Late Woodland triangular points are indeed significant.

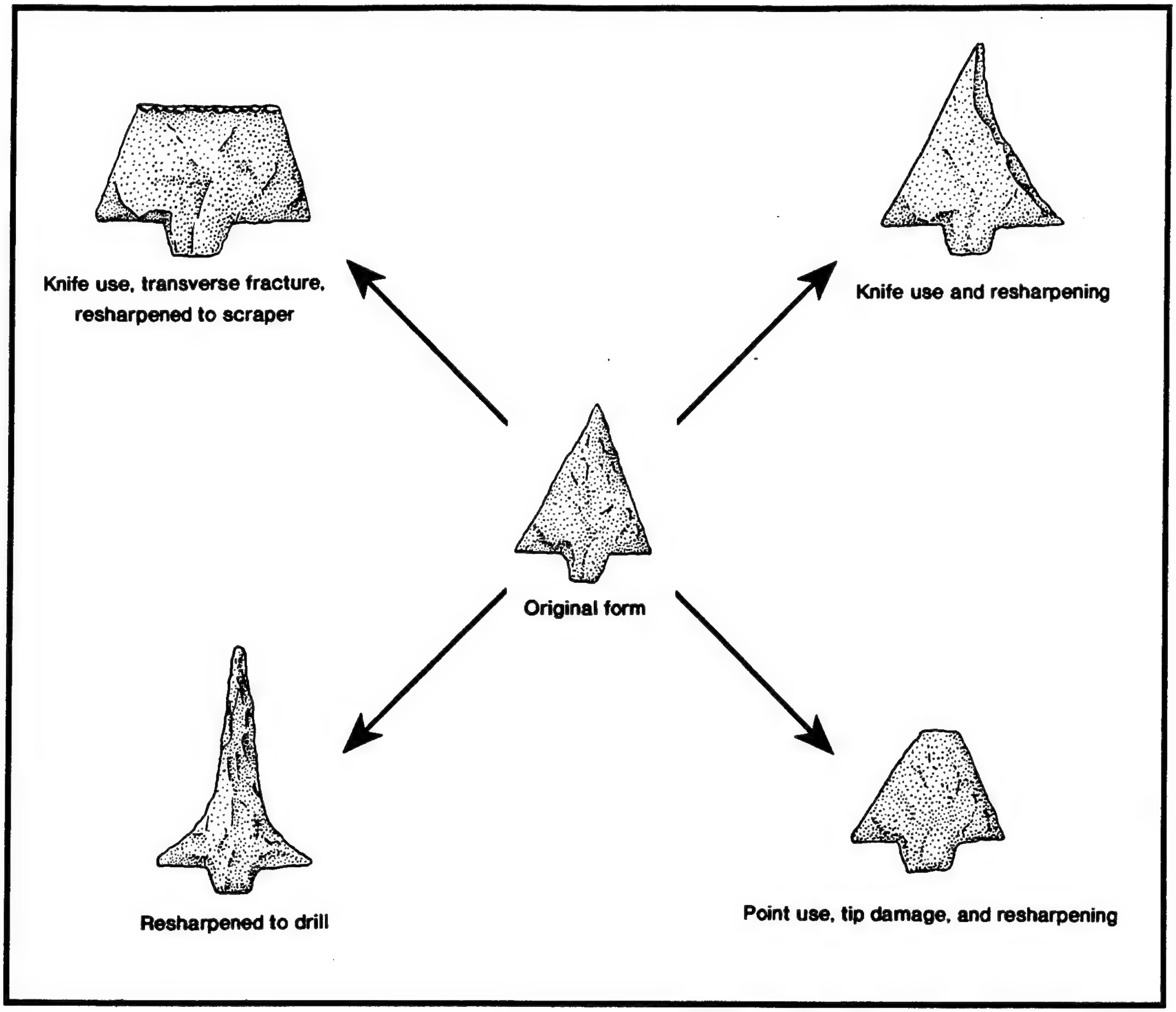
Transverse medial fractures indicative of knife use (Ahler 1971) were also present among the Middle Archaic points (Table 55) and occurred on 17% of them (Figures 77i, 77l, 78k, 78o, 78v, and 78w). This percentage again is similar to values seen for Late Archaic stemmed points (12%) and Late Woodland triangular arrow points (10%) (Custer 1991:69). Application of the difference-of-proportion test shows no significant differences. Transverse medial fractures were more common on broadspears (32%) (Custer 1991:69) and this percentage is significantly larger than the values seen for the other point types. The frequencies of these breakage patterns suggest that the primary use of the projectile points in the Middle Archaic assemblage from West Water Street was as penetrating projectiles. Nevertheless, on rarer occasions some of the points were used as knives.

In some cases, the points from the Middle Archaic component were resharpened into other tools. Four points were resharpened into scrapers (Figure 78j, k, and p) and in some cases they are resharpened across the surface of medial transverse fracture planes. One point (Figure 77k) showed alternate beveled resharpening suggesting systematic use of the point as a knife. This kind of resharpening has been noted in other similarly dated point assemblages (Lowery and Custer 1990). Drills are also present in the assemblage (Figures 77h and 78q-t). Some of the drills (e.g. - Figure 77h) appear to have been produced by resharpening a projectile point. On the other hand, other drills appear to have been made especially as drills. Figure 78q shows a drill especially manufactured from a flake.

Nine projectile point stem fragments were found in Segment D and four examples are shown in Figure 78 (x-aa). The fragments appear to have been broken just below the juncture of the blade and the stem. Replicative studies (e.g. - Ahler 1971; Odell and Cowan 1986) have shown that these kind of fractures occur during projectile point use when the hafting element is not tight and the point "wiggles" on impact. The blade shears off and the stem remains in the haft. The point use associated with these fractures would not occur at a living site and the presence of these kinds of point fragments at the site implies that broken points still mounted in foreshafts of spears were brought back to the site for retooling. The points' stem fragments were probably then discarded and the foreshafts reused.

FIGURE 110

Use and Resharpening of Neville/Stanly Projectile Points



The Middle Archaic projectile point assemblage from the West Water Street Site shows some interesting trends in projectile point manufacture and use. One important trend is the use of flakes for point manufacture. Although some use of flakes for point manufacture occurred during earlier Paleo-Indian/Early Archaic times (e.g. - Johnson 1989; Geier 1990) and later Late Woodland times (e.g. - Custer et al. 1993), Middle Archaic points show the most frequent use of flakes. Use of flakes for point manufacture is a much more expedient technology than staged biface reduction, and the significant reliance on an expedient point manufacturing technique during Middle Archaic times may indicate that this portion of the lithic tool kit was not as highly curated as it was during earlier time periods. Because curation is linked to high degrees of mobility (Custer 1990:35-36), the increase in expedient point technologies during Middle

Archaic times may indicate a reduction in mobility. Other types of data have also been noted in support of this contention (Custer 1990:26-30).

There are few other large projectile point assemblages with which those from West Water Street can be compared; however some comments can be noted. Cook (1976) provides a description of two comparable point assemblages from the Koster Site in west central Illinois. Although the styles of the Illinois projectile points differ from those of West Water Street, the use breakage and resharpening patterns are remarkably similar. Figure 110 shows the use and resharpening patterns. The basic stemmed point shape was primarily intended for projectile point use. As tips were damaged, points were continually resharpened until they were no longer useful. Occasionally, the points were used as knives and their edges were resharpened into asymmetrical forms with one or more incurvate edges. If a transverse fracture occurred, the point could be resharpened across the fracture to serve as a scraper. Finally, points could also be shaped into drill forms.

The multiple use of a basic form primarily intended as a projectile point is seen in the Illinois examples, the Middle and Early Archaic assemblages from the Rose Island Site (Chapman 1975), and numerous Paleo-Indian/Early Archaic assemblages (Carr 1986). Point use in Late Archaic - Late Woodland assemblages is quite different with a variety of different point forms used for different purposes (e.g. - Custer and Bachman 1985). The continuity in the organization of projectile point technologies from Paleo-Indian - Middle Archaic times underscores other observed similarities in lifeways and adaptations during this time frame (Custer 1990).

Bifaces. A total of 61 bifaces that could be categorized by reduction stage (Callahan 1979) and 48 additional biface fragments were recovered from the West Water Street Middle Archaic component. Table 56 show the comparative use of raw materials within the biface assemblage. The biface assemblages from individual segments are too small for detailed analysis; however, in all segments chert and jasper bifaces comprise more that 65% of the biface assemblage. Chert is also always much more commonly used than jasper, but jasper is more common than other non- chert raw materials.

Because of the small samples from individual segments, it is necessary to combine the data from individual segments for analysis. When comparing lithic resource use between early and late stage bifaces, some differences seem to be present with the proportions chert, jasper, and rhyolite apparently varying between the early and late stage biface assemblages. However, application of a difference-of-proportion test shows no significant differences. Therefore, raw material use preferences are the same for both stages of biface reduction, even though some raw materials are locally available and others are not.

TABLE 56
Raw Material Use Among Varied Biface Stages

Segment	Type	Number	Raw Material*					
			Chert	Jasper	Quartz	Rhyolite	Argillite	Other
A	Early	1	100	---	---	---	---	---
	Late	0	---	---	---	---	---	---
B	Early	7	57	29	---	---	14	---
	Late	9	67	33	---	---	---	---
C	Early	6	50	17	---	---	17	16
	Late	6	67	---	---	33	---	---
D	Early	16	69	12	---	12	---	7
	Late	16	81	6	---	13	---	---
Combined	Early	30	63	17	---	7	7	6
	Late	31	77	13	---	10	---	---
	Total**	**109**	**64**	**24**	**3**	**6**	**2**	**1**

* All raw material values are percentages
** Including biface fragments

Figure 111 shows a sample of the bifaces from the West Water Street Middle Archaic component. An additional Middle Archaic biface from the site is depicted in Figure 78w. Early stage bifaces are sometimes derived from large flakes (Figures 111e-g). In some cases the initial flake blank was rather thick (Figures 111e and f). The specimens in Figure 111e and f both appear to be derived from bipolar splitting of a rounded core or pebble, but no weathered cobble cortex is apparent. The remnant cortex may have been removed, however, by subsequent reduction and edging. This bipolar technique is of interest because similar techniques are common at Rose Island, a Middle Archaic Site in Eastern Tennessee (Chapman 1975). The specimen in Figure 111g is made from a very thin flake and was not derived from bipolar reduction. Some other early stage bifaces (Figure 111h-j) are derived from reduction of slab-like pieces of raw materials, not flakes. Reduction of early stage bifaces <u>not</u> based on flakes seems to have experienced more flint knapping problems such as misplaced thinning blows (Figure 111h), internal fracture planes (Figure 111i), and raw material flaws and impurities (Figure 111j).

Late stage biface reduction apparently was directed toward the production of two tool forms. Some late stage bifaces (Figure 111o-p) clearly were intended to become Neville points. The specimen in Figure 111o already had the characteristic Neville stem produced. Other late stage bifaces (Figures 78w and 111k-m) are large and clearly not intended to be Neville points. Smaller late stage bifaces (Figure 111n) also do not appear to be Neville preforms. The presence of the larger late stage bifaces is interesting because both Early Archaic (e.g. - Lowery and Custer 1990) and Paleo-Indian (e.g. - Verrey 1986) biface assemblages show the same pattern of production of smaller points and large bifaces that are not necessary preforms in the point production sequence. It is believed that the large bifaces were

FIGURE 111
Middle Archaic Bifaces

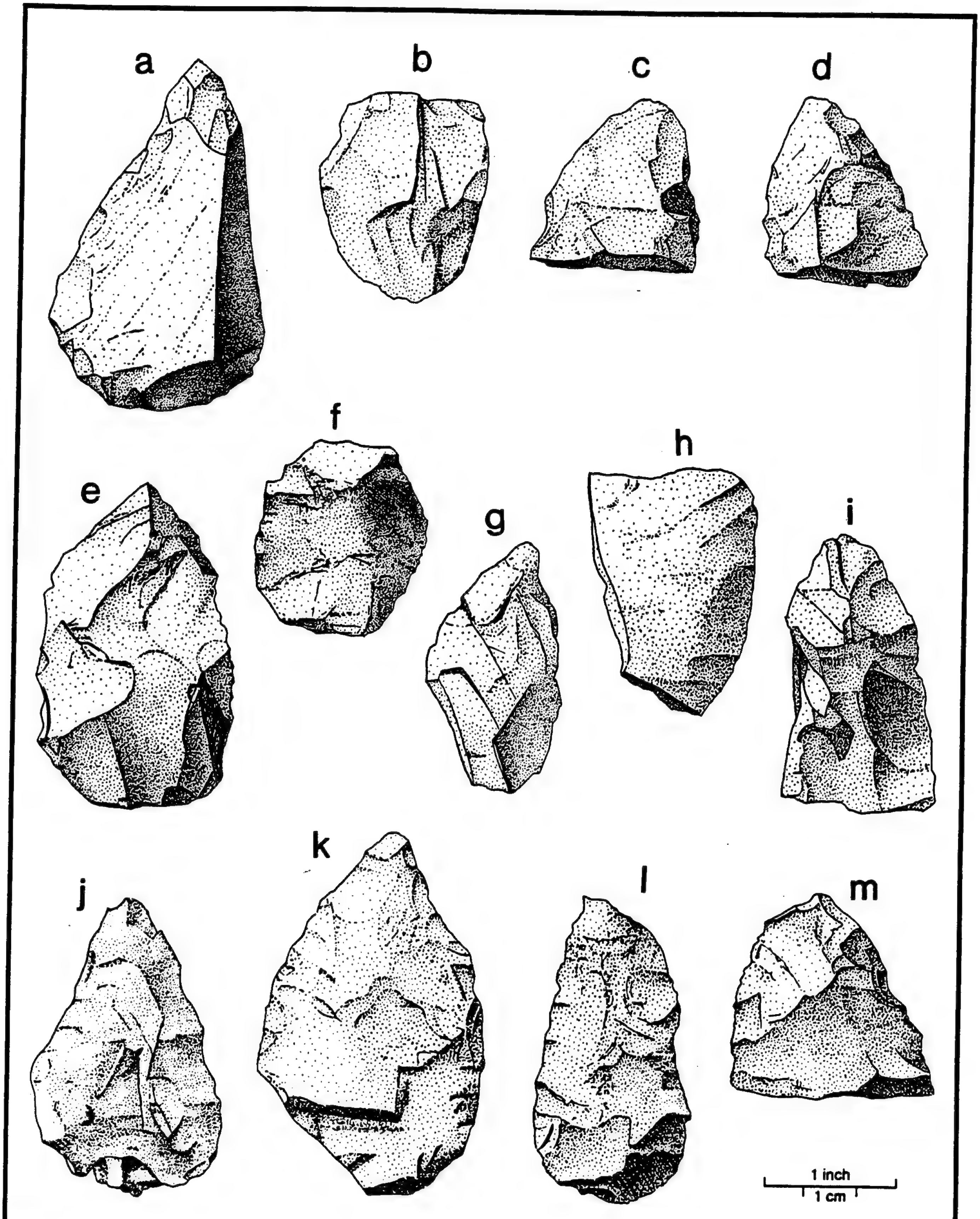


FIGURE 111 (Continued)
Middle Archaic Bifaces

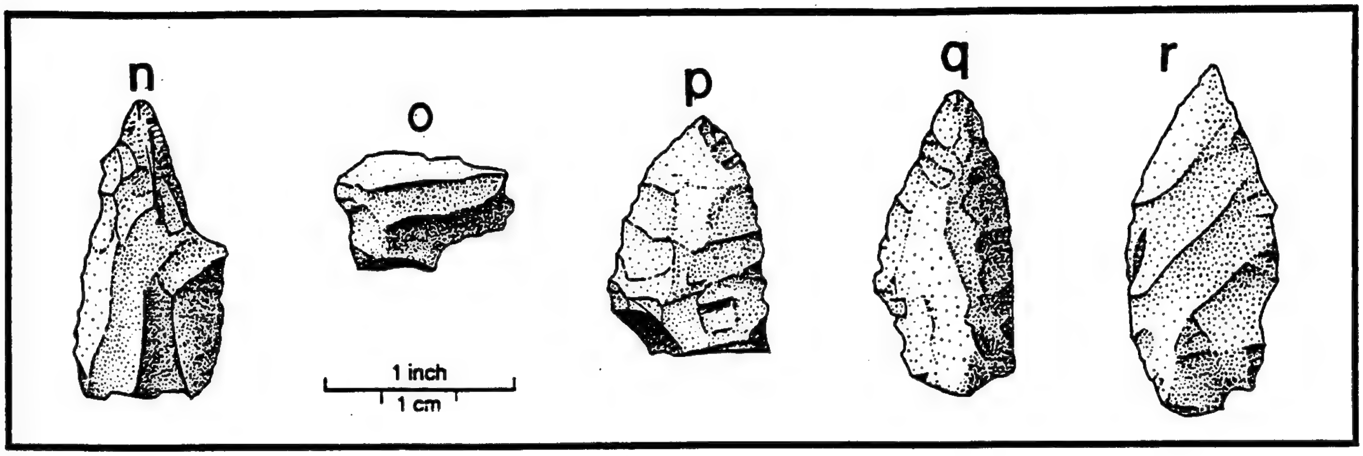
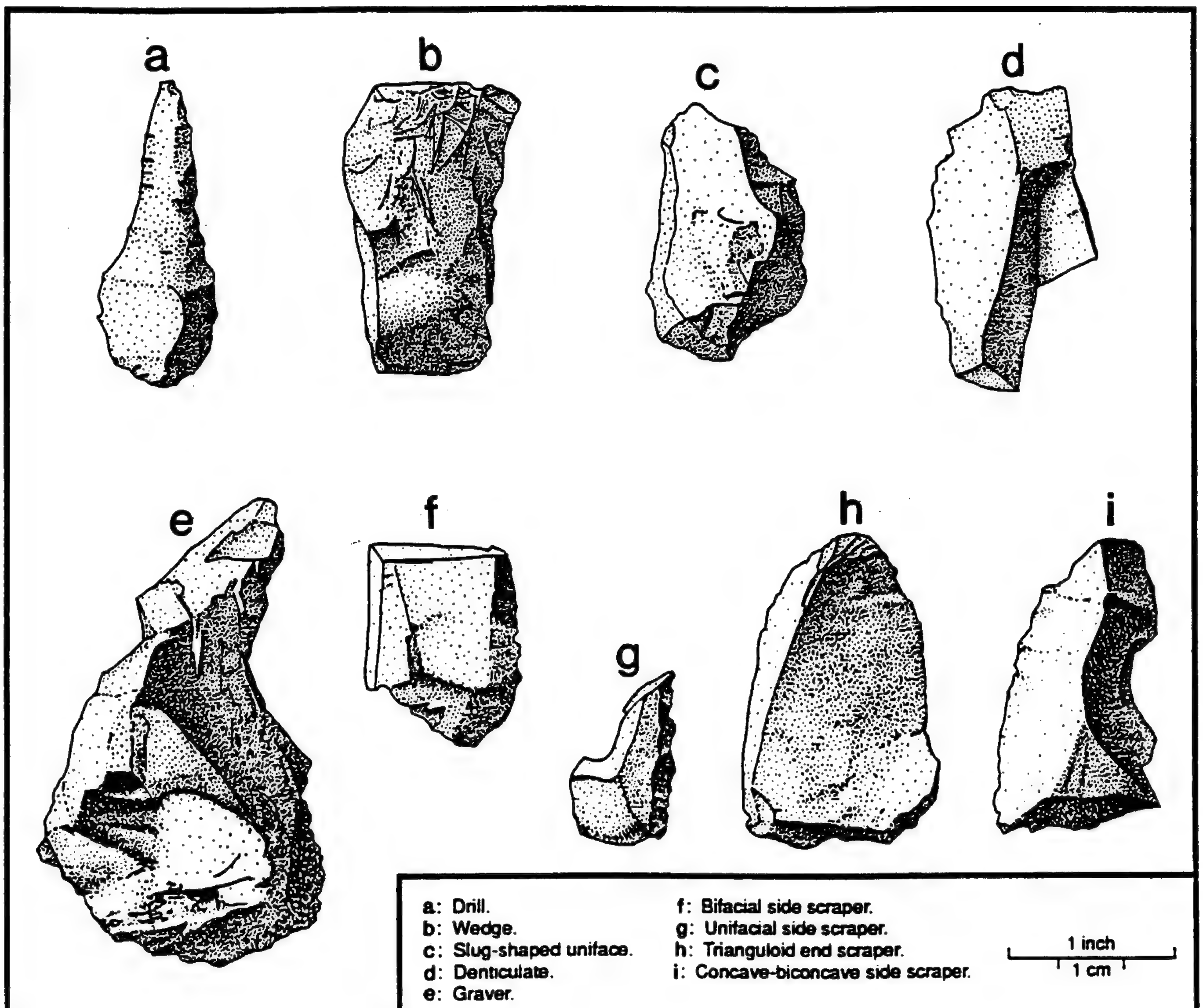


FIGURE 112
Sample Middle Archaic Flake Tools



a: Drill.
b: Wedge.
c: Slug-shaped uniface.
d: Denticulate.
e: Graver.
f: Bifacial side scraper.
g: Unifacial side scraper.
h: Trianguloid end scraper.
i: Concave-biconcave side scraper.

made to be part of a curated tool kit where the bifaces were used as tools in and of themselves, as core sources for flakes to make specialized tools, and eventually to become projectile points when reduction was complete. The West Water Street biface assemblage shows that this kind of use of staged biface reduction, focused on cryptocrystalline materials, within a highly curated tool kit occurred during Middle Archaic times. Therefore, there is significant continuity in biface technologies, and the organization of tool kit curation, from Paleo-Indian through Middle Archaic times. Because high levels of mobility are linked to the carefully curated technologies during Paleo-Indian/Early Archaic times (Custer and Stewart 1990; Goodyear 1979), the presence of such tool kits in Middle Archaic assemblages could imply similarly high group mobility levels. However, the previously noted increase in expediently manufactured tools in Middle Archaic assemblages suggests reduced mobility. It is possible that these two features of Middle Archaic tool kits indicate the <u>beginnings</u> of group mobility reduction.

Two additional biface specimens are worthy of special comment. The specimen illustrated in Figure 111q is a late stage biface, probably a Neville preform, manufactured from a long, thin flake. Although it is difficult to say for certain, the jasper flake upon which the biface was based was itself a biface thinning flake from a rather large biface. Use of a biface thinning flake to make another biface is further confirmation of the inferred functions of the bifaces noted above. The specimen in Figure 111r is worthy of special comment due to the long oblique flake scars which run the entire width of the biface. These long flake scars are testaments to the Middle Archaic flintknapper skills and may indicate that this biface was once much larger than its present size.

Four rhyolite bifaces are also illustrated in Figures 111a-d. Three of the bifaces (Figure 111b-d) are rather thick bifaces which were broken by misplaced thinning blows during the final stages of late stage reduction. The rhyolite biface in Figure 111a is actually a large rhyolite flake with initial biface edging present on its margins. The fracture down the center of the artifact probably occurred during that initial edging. The presence of these rhyolite bifaces in rather early stages of reduction is of interest because it indicates that rhyolite bifaces and large flakes were part of the curated technology. A similar conclusion was reached during the analysis of rhyolite projectile points. In sum, the West Water Street Middle Archaic biface assemblage shows stone tool curation strategies similar to those seen at earlier Paleo-Indian and Early Archaic sites.

<u>Flake Tools and Utilized Flakes</u>. Table 53 provides a summary catalog of the flake tools and utilized flakes from each segment of the West Water Street Site and Figure 112 shows samples of the various tool forms. The data on lithic resource use in Tables 49-52 show that 95% of the flake tools and utilized flakes are made from cryptocrystalline materials.

TABLE 57
Cumulative Percentage Data for Lithic Tool Kit Comparisons

Tool Type	Segment A	Segment B	Segment C	Segment D	Segments B,C,D	Crane* Point	Paw Paw* Cove	Slackwater**
1	5	5	11	14	11	18	19	9
2	5	12	16	20	17	23	25	26
3	6	17	22	26	23	24	25	41
4	6	17	25	27	24	25	25	42
5	10	23	28	29	27	25	27	51
6	13	27	34	32	31	27	32	51
7	16	33	37	34	34	29	41	52
8	23	39	41	38	39	32	47	64
9	23	39	42	38	39	33	48	64
10	26	40	45	39	41	34	49	65
11	28	52	61	45	50	34	49	75
12	28	53	64	46	52	36	55	75
13	29	56	68	49	55	36	57	77
14	31	58	70	51	57	38	64	80
15	95	96	98	94	96	83	88	100
16	100	100	100	100	100	100	100	100

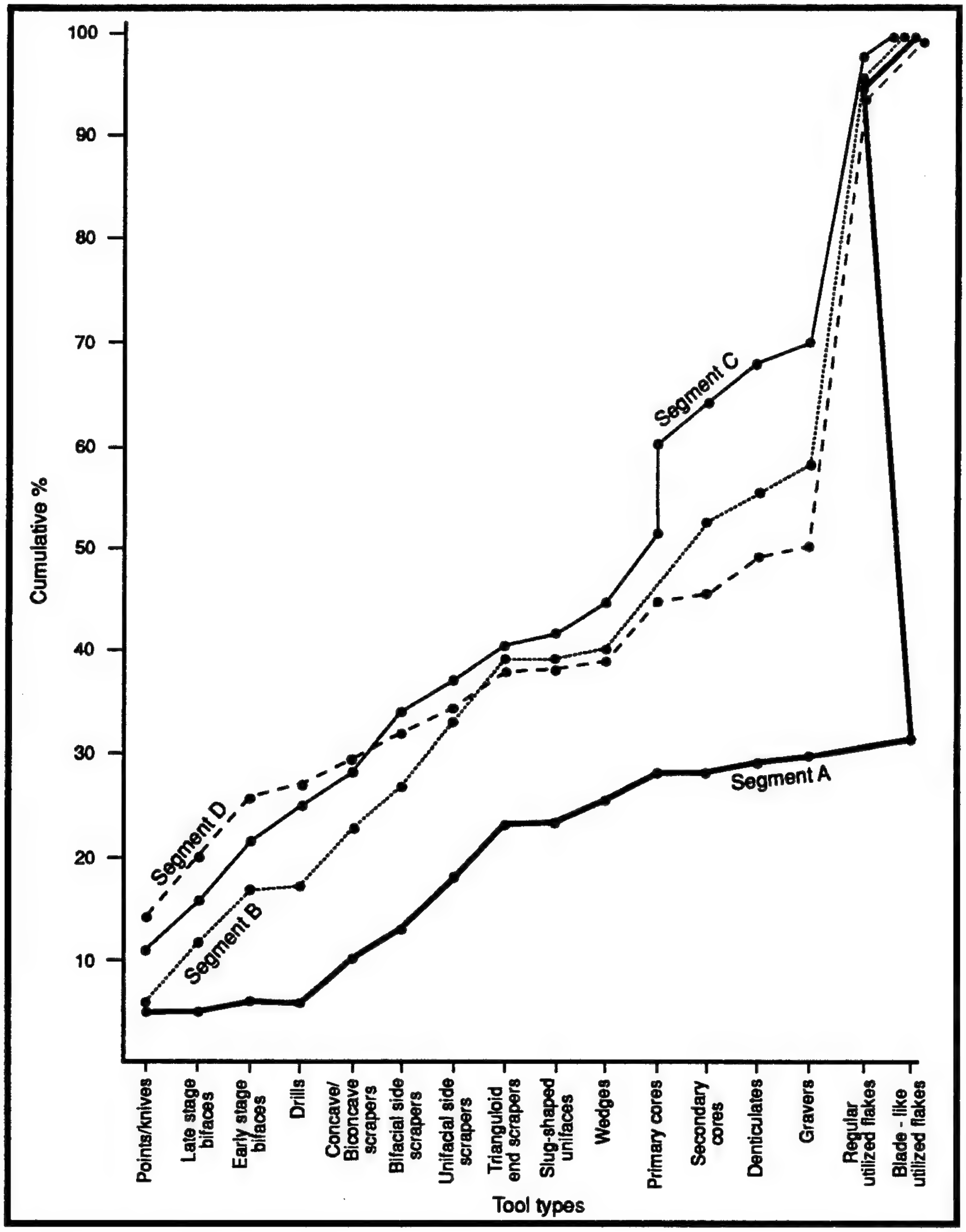
*Lowery and Custer 1990:110
**Custer et al. 1993

The format for the tabulation of tool types in Table 53 is taken from the work of Lowery and Custer (1990), which in turn was derived from the work of Bordes (1961). The data in Table 53 clearly show that a wide variety of formal flake tool types are present in all segments of the West Water Street Middle Archaic component, even in segments with small samples, such as Segment A. Many of the specific tool forms, such as the varieties of side and end scrapers (Figures 112f-i), have been viewed as allegedly "diagnostic" artifacts for the Paleo-Indian Period (e.g. - Gramly and Lothrop 1984). However, Lowery and Custer (1990) have shown that these tool forms can also occur within Early Archaic assemblages and Riley, Watson, and Custer (1993) have shown that they can be present in Late Archaic - Middle Woodland assemblages. The data in Table 53 show that these tool types are also present in Middle Archaic tool kits and, therefore, can be present in any tool kits ranging in age between 9500 B.C. and A.D. 1000. Consequently, their diagnostic value as chronological marker is quite low.

The format used in Table 53 allows a comparison of the segments with one another and with similarly organized data from other sites. The method of comparison is drawn from the work of Bordes (1968) and involves the construction of cumulative percentage curves based on the tool type frequencies and comparison of the curves' shapes. Table 57 lists the cumulative percentage data used in the construction of the cumulative percentage curves. Figure 113 shows a comparison of the cumulative percentage curves for each segment at the West Water Street Site. Segments B and D are the most similar. Segment C is also similar to Segments B and D, but differs somewhat with its higher percentages of cores and denticulates. Segment A is different from the other three segments and had lower percentages of bifaces and formalized flake tools. Segment A also differed from the other Middle Archaic segments because it had bifurcate and early triangular points, rather than Neville points, and its

FIGURE 113

Comparison of Middle Archaic Tool Kits from Each Segment

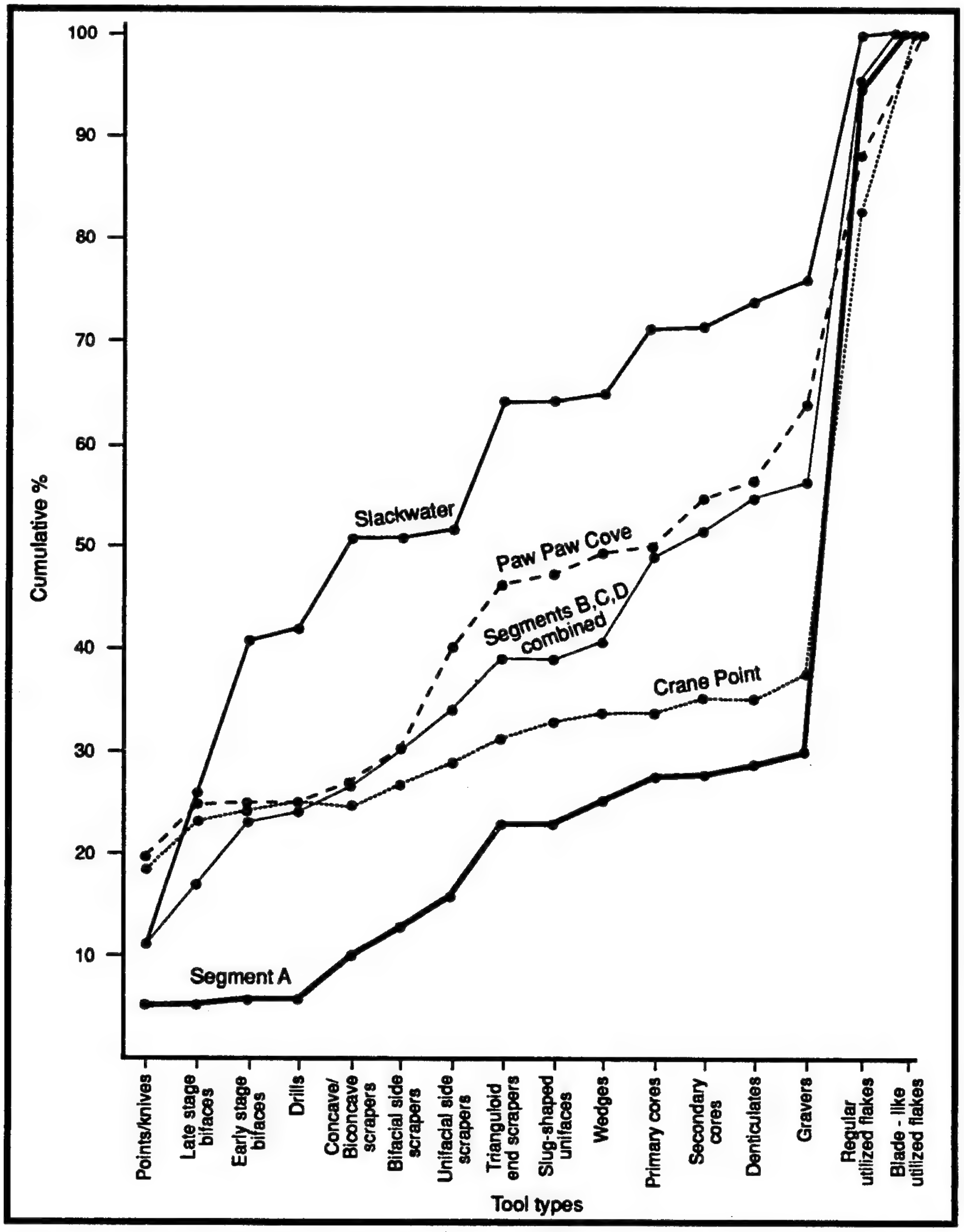


occupation may be older than those of other segments. Its different tool kit composition further underscores the differences in projectile point forms.

Figure 114 shows a comparison of cumulative percentage curves for Segment A, a composite of Segments B-D, the Crane Point Early Archaic Site (Lowery and Custer 1990), the Paw Paw Cove Paleo-Indian Site (Lowery 1989), and the Slackwater Shenks Ferry (Late Woodland) Site (Custer et al. 1993). These sites were chosen for comparison because their tool kit data are ordered in a fashion to allow ready comparison with the West

FIGURE 114

Comparison of Middle Archaic Tool Kits with Paleo-Indian, Early Archaic, and Late Woodland Examples



Water Street Middle Archaic data. Because the Crane Point and Paw Paw Cove sites are located in the Coastal Plain of Maryland, differences in physiographic setting and lithic resource availability must be considered during the comparison. In general, the combined assemblage from Segments B, C, and D is very similar to the Paw Paw Cove Paleo-Indian and Crane Point Early Archaic assemblages. The assemblage from Segment A differs from the other assemblages, but is most similar to that from Crane Point. The most pronounced differences among the assemblages occur in the projectile point and biface categories and in the formalized scraper categories, especially end scrapers.

Figure 114 also includes a cumulative percent curve for the Late Woodland Slackwater Site. Its curve is quite different from the others and shows a much lower proportion of simple flake tools compared to the earlier assemblages. When all assemblages are considered, the combined assemblage from Segments B, C, and D, Crane Point, and Paw Paw Cove are more similar to the Slackwater assemblage than the Segment A assemblage. The Segment A assemblage is the smallest sample among those shown in Figure 114, and its differences from the other assemblages may be due solely to sample size. However, the small size of the Segment A assemblage and its different composition may indicate that it is a more ephemeral occupation than the other occupations represented by the assemblages in Figure 114.

Cores. A total of 48 cores were recovered during excavations of the Middle Archaic occupation and are listed in the summary artifact catalogs (Tables 49-52). Only six (12%) of these cores showed any sign of cobble cortex which clearly shows that local river cobbles and pebbles were not commonly used as lithic raw material sources. The low incidence of cortex (< 1%) among debitage (Tables 49-52) also supports this contention. Only six cores (four with cortex, two with no cortex) show signs of bipolar reduction. This form of reduction is most commonly associated with cobble and pebble reduction (e.g. - Chapman 1975) and its low incidence in the West Water Street assemblage is consistent with the low incidence of cobble use. Most of the cores were made from slabs or chunks of bedrock and all but three cores were made from chert.

Only five cores show any sign of utilization. The vast majority of the cores (90%) were discarded when they were no longer large enough to produce additional useful flakes. However, seven cores are rather small (less than 3 cm in their longest dimension), and appear to have been used to produce very small flakes. Six cores, three of which are the small examples noted above, show signs of removal of blade-like flakes. None of these cores show extensive platform preparation or the initial specialized shaping associated with specialized blade cores (e.g. - Johnson 1986). The low incidence of signs of blade-like flake production among the cores is also reflected by the low incidence of blade-like utilized flakes which comprise less than 10% of the utilized flake assemblage.

Cores from the Middle Archaic component were also categorized by their shape (blocky vs. tabular) and method of reduction (polyhedral vs. bifacial) following conventions noted by Custer (1986a). Table 58 shows these data for each segment and all segments combined. Segment D shows the most diverse core assemblage; however, its assemblage, and that of the other segments, are overwhelmingly dominated by blocky polyhedral cores. Blocky cores reduced in a polyhedral manner are generally viewed as one of the most expedient core technologies (Custer 1986a). However, they are not as expedient as cobble cores reduced using bipolar flaking techniques.

TABLE 58
Middle Archaic Core Data

	Blocky	Tabular
Segment A		
Polyhedral	1	0
Bifacial	0	0
Segment B		
Polyhedral	9	3
Bifacial	0	1
Segment C		
Polyhedral	15	1
Bifacial	0	0
Segment D		
Polyhedral	11	0
Bifacial	2	4
Combined		
Polyhedral	36	4
Bifacial	2	5

TABLE 59
Miscellaneous Stone Tools - Middle Archaic Occupation

	Segment				
Artifact Type	**A**	**B**	**C**	**D**	**Total**
Hammerstones	8	2	4	5	19
Pitted anvils	2	3	7	10	22
Teshoas	0	5	0	5	10
Netsinker	0	0	0	1	1
Pestle	0	0	1	0	1

In sum, the cores from the Middle Archaic component of the West Water Street Site form an expedient tool technology that complements the formal, curated biface technology. Cores were manufactured from slabs and chunks of bedrock chert, probably procured from local upland settings in the immediate vicinity of the site. Cobble and pebble cherts from the bed load of the West Branch of the Susquehanna River, which were used by later prehistoric inhabitants of the site were <u>not</u> used by Middle Archaic groups. In spite of differences in raw material use for biface technologies among the segments, core technology and raw material use for manufacturing cores vary little among the segments.

<u>Miscellaneous Stone Tools</u>. Table 59 lists numerous miscellaneous stone tool types encountered in the Middle Archaic occupation. Hammerstones and pitted anvil stones are the most common of these tools and are associated with stone tool production and possibly processing of plant foods, such as nuts. Chapman (1975) and Dincauze (1976) both note the presence of similar tools in Middle Archaic contexts. These tools are not commonly seen in earlier tool assemblages and are thought to be related to increased use of plant food resources during Middle Archaic times. The presence of these tools at West Water Street indicates that the site's inhabitants may have been participating in similar subsistence pattern changes.

Teshoas, which are defined by Kraft (1975) as generalized cutting tools manufactured by producing a cutting edge on a split cobble or slab of coarse lithic material, are also present. The teshoas from West Water Street are manufactured from sandstone and quartzite and probably did function as generalized cutting tools. A netsinker and pestle are also present and complete the assemblage of miscellaneous stone tools. In sum, the appearance of a few varieties of miscellaneous ground and chipped tools in the West Water Street Middle Archaic assemblage fits with patterns seen at other similarly dated sites and may indicate an increased use of plant food resources.

TABLE 60
Raw Material Percentages Among Debitage

Segment	Number	Chert	Jasper	Quartz	Rhyolite	Argillite	Other
		Raw Material					
A	458	52	27	<1	10	5	6
B	3299	66	23	<1	1	2	7
C	2379	60	4	<1	2	<1	4
D	4678	77	9	<1	6	5	2

TABLE 61
Middle Archaic Flake Attribute Data

	Biface Control	Core Control	A	B1	B2	C1	C2	D1	D2	D3	D4	D5
Flake Type												
Complete	12	63	38	74	42	64	78	38	30	60	58	32
Proximal	28	19	22	6	22	8	6	18	26	20	20	6
Medial	26	4	14	10	24	12	8	24	18	6	10	38
Distal	35	14	26	10	12	16	8	20	26	14	12	24
Size												
Small	78	49	62	76	68	78	66	88	94	80	70	94
Medium	20	46	36	24	30	20	34	12	4	20	28	4
Large	2	5	2	0	2	2	0	0	2	0	2	2
Platform Shape												
Triangular	81	10	26	18	22	25	7	18	15	0	31	26
Flat	7	37	23	40	26	25	27	11	23	36	41	11
Round	12	35	50	42	52	50	66	71	62	64	28	63
Remnant Biface Edge												
Present	19	3	4	10	20	8	20	10	6	12	6	10
Absent	81	97	96	90	80	92	80	90	94	88	94	90
Platform Preparation												
Present	88	10	23	18	13	27	15	36	38	31	26	26
Absent	12	72	77	82	87	73	85	64	62	69	74	74
Scar Count												
Mean	2	1	2	3	2	2	3	2	2	3	2	2
Standard Deviation	1	1	1	1	1	1	1	1	1	1	1	1
Scar Direction Count												
Mean	2	1	2	3	2	2	2	2	2	2	2	2
Standard Deviation	1	1	1	1	1	1	1	1	1	1	1	1

TABLE 62
Middle Archaic Flake Attribute Analysis

	A	B1	B2	C1	C2	D1	D2	D3	D4	D5
Flake Type*	core	core	core	core	core	biface	biface	core	core	biface
Flake Size	biface	biface	biface	biface	biface	biface	biface	biface	biface	biface
Platform Shape*	core	core	core	core	core	core	core	core	core	core
Remnant Biface Edge*	core	?	biface	core	core	core	core	core	core	core
Platform Preparation*	core	core	core	core	core	core	core	core	core	core
Scar Count	biface	biface	biface	biface	biface	biface	biface	biface	biface	biface
Scar Direction	biface	biface	biface	biface	biface	biface	biface	biface	biface	biface

* - Most critical discriminating attributes

Debitage. More than 10,000 pieces of debitage were recovered from the West Water Street Site. Table 60 summarizes the raw material distributions among the debitage. The segments are all rather similar in terms of raw material use as indicated by debitage, with chert comprising the majority of the assemblage. The debitage data on raw material use is consistent with the patterns of lithic use seen among other artifact classes.

Samples of Middle Archaic debitage were analyzed for flake attributes using the same methods used for the analysis of the rhyolite flakes from the Late Archaic component. Ten samples of 50 flakes each were taken from the artifact clusters noted in the distribution map (Figures 79-109). One sample each was taken from Segment A and the west half of Segment D, two samples from Segments B and C, and four samples from the east half of Segment D. Figure 115 shows the locations where multiple samples were taken within individual segments. Table 61 lists the flake attribute data for each sample along with the control examples from core and biface reduction.

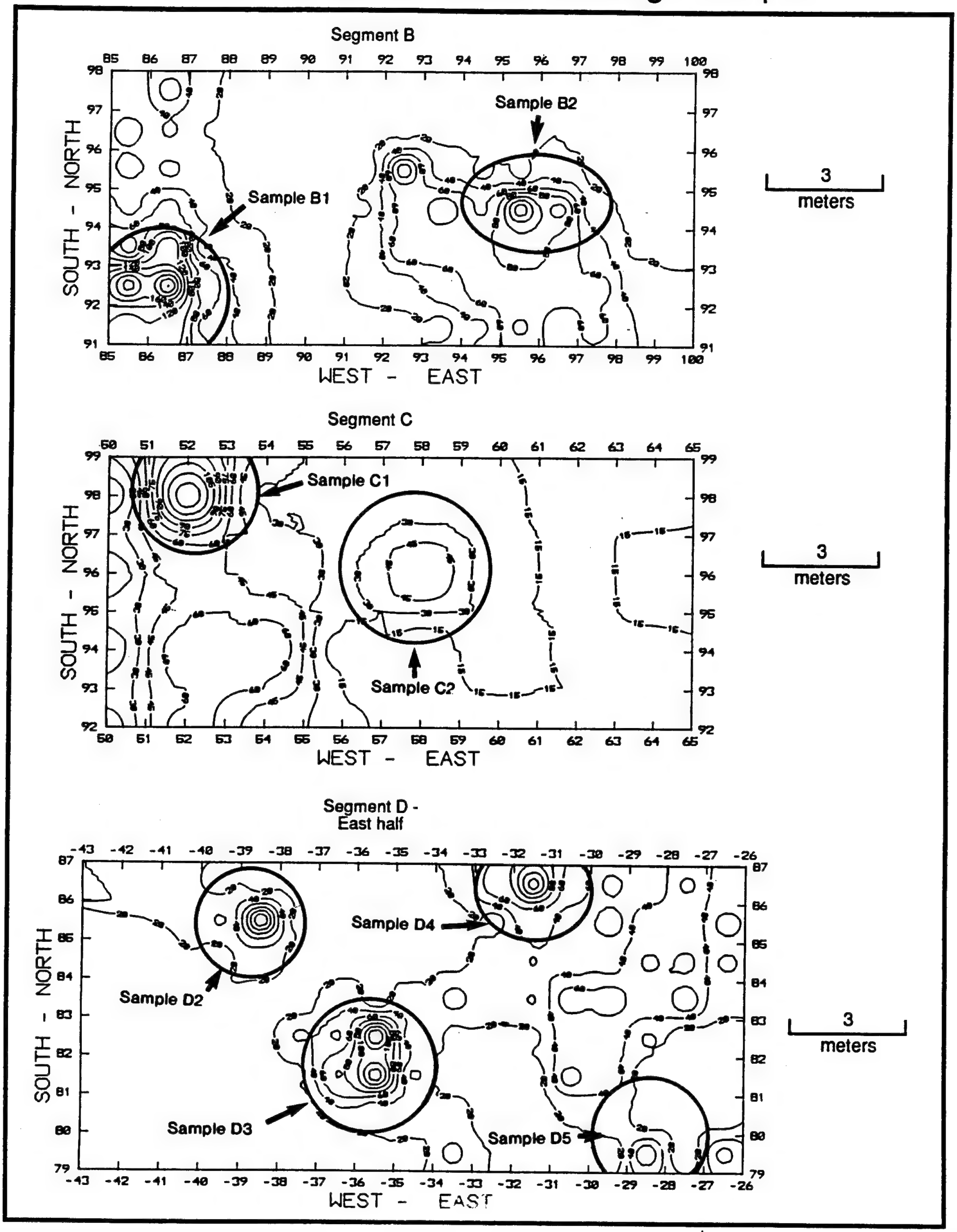
Not all of the attributes are equally useful for identifying core verses biface debitage. The four most useful attributes are flake type, platform shape, presence of remnant biface edge, and presence of platform preparation. Flake size is not always a useful discriminating attribute because of the variable size of the initial raw material source. Scar count and scar direction count are also not always useful because there is not that much variability among the control data. Table 62 shows an analysis of the flake attribute data and the data for each attribute of each sample were classified based on their similarity to the core and biface control samples. The similarities for the attributes are noted in the table.

For the attributes that best discriminate between core and flake debitage, the data clearly show that core reduction was more common than biface reduction. Among the other attributes, the data more closely approximate the biface reduction control data. Given the discriminatory utility of the variables, however, the flake attribute data would indicate the core reduction was the predominant lithic reduction activity. This reduction was probably part of expedient flake tool production as evidenced by the core data discussed earlier.

Discussion

The excavations of the Middle Archaic component of the West Water Street Site revealed important data on the early Holocene inhabitants of the West Branch Valley of the Susquehanna Valley. The well preserved context of these deposits enhanced the quality of the information and the archaeological data presented in this section of the report meets the research design goal of basic data description of the Middle Archaic component. A second goal of the Middle Archaic research design was to identify the nature of the prehistoric settlement pattern at the site during this

FIGURE 115
Location of Middle Archaic Debitage Samples



time period. The analysis of the artifact distribution maps for all segments clearly shows that the occupations were small family units whose settlement locales were not linked into a large base camp with marked spatial differentiation of activity areas. There is no way to know if the occupations occurred contemporaneously; however, it is hypothesized that they were not contemporaneous. The Middle Archaic occupations at West Water Street are very similar to those seen at other Middle Archaic sites (e.g. - Stewart and Cavallo 1991), and are more similar to Paleo-Indian and Early Archaic occupations than they are to later Late Archaic occupations.

The Middle Archaic lithic technologies at the West Water Street Site also more closely resemble Paleo-Indian and Early Archaic tool kits than they do Late Archaic tool assemblages. A highly curated biface technology was in use, and flakes from the bifaces were used to produce specialized unifacial, and occasionally bifacial, tools. However, a large number of cores were used on an expedient basis to produce simple flake tools and utilized flakes. The cores seem to be made from slabs of bedrock chert that could be found in the local area. River cobbles were not commonly used. Local cherts were also used to replenish the curated portion of the tool kit. The overall impression of the stone tool technological system of Middle Archaic groups is that they were maintaining a curated technology based on bifaces and used this curated tool kit when they traveled through areas where suitable lithic raw materials were not available. When they reached a locale where suitable lithic raw materials were available, they replenished the curated tool kit and then used the locally available raw materials on an expedient basis to save the curated portion of the tool kit. When they left the site, they had a fully replenished curated tool kit in hand. This kind of stone tool technological organization is very typical of Paleo-Indian/Early Archaic groups (e.g. - Gardner 1989; Custer 1990) but is not so commonly seen during later time periods (e.g. - Custer and Bachman 1985).

Overviews of Archaic adaptations in the local area (Turnbaugh 1977), the Middle Atlantic (Stewart and Cavallo 1991), and the Northeast (Funk 1978) all stress that new adaptations and lifeways emerged at the time of the Paleo-Indian transition. However, the data presented here, and earlier studies by Gardner (1989), suggest that there was a great deal of continuity in lithic technology running through the Paleo-Indian, Early Archaic, and Middle Archaic Periods. This continuity is probably due to continued high mobility levels. Other aspects of adaptations, such as regional settlement patterns do show changes during the Archaic, however. The interesting observation is that culture change does not always occur contemporaneously, or at the same rate, in all cultural sub-systems.

EARLY ARCHAIC/LATE PALEO-INDIAN COMPONENT EXCAVATION RESULTS

Introduction

At the beginning of data recovery excavations, the deepest component tested at the West Water Street Site was thought to date to the Early Archaic/Late Paleo-Indian Period. This component was the only one at the site that had not produced diagnostic artifacts during Phase II testing. The age of the occupation was determined by a radiocarbon date of 9430 $\pm$ 310 B.P. The proposed Early Archaic/Late Paleo-Indian age was confirmed during data recovery excavations by the recovery of three Kirk/Palmer projectile points. Additional artifacts found in this occupation included bifaces, cores, flake tools, and debitage.

As has been previously mentioned in this report, the Early Archaic/Late Paleo-Indian period is somewhat better known in the Middle Atlantic area than is the younger Middle Archaic Period. However, sites from this earlier period are still poorly represented in northcentral Pennsylvania (Turnbaugh 1977:97). Research issues concerning the nature of Early Archaic/Late Paleo-Indian diet, subsistence, and settlement patterns are far from resolved, and the West Water Street Site was thought to have the potential to provide significant information on these problems. In general, this goal was realized, although in some cases the quantity of data was less than anticipated.

Phase II testing of the Early Archaic/Late Paleo-Indian occupation produced modest amounts of well preserved faunal material, and additional testing was hoped to provide more of the same. Unfortunately, no additional faunal material was recovered, and no additional insights into prehistoric diets from this period were acquired. In addition, the discovery of four separate artifact deposits in the Early Archaic/Late Paleo-Indian component necessitated a reduction in the horizontal extent of the excavation of each deposit. Initial plans had called for the excavation of 50 contiguous 1 m units in both Segments B and C, with the assumption that only one occupation was present in each segment. Upon the discovery that two occupations were present in each segment, the data recovery plan was modified. With the approval of the Corps of Engineers and the Pennsylvania State Historic Preservation Office, 25 units were excavated in each of the separate artifact deposits in Segments B and C. Although the total amount of horizontal exposure remained the same, this exposure was now spread out over four occupations, instead of the original two. Consequently, the amount of information on artifact spatial distributions was somewhat reduced. Finally, the actual numbers of artifacts present in all artifact deposits in the Early Archaic/Late Paleo-Indian component was less than anticipated.

Despite these limitations, important information was recovered from the Early Archaic/Late Paleo-Indian component of the West Water Street Site, and the results of the excavations

follow. The context of the artifacts from this component is presented first, and is followed by a description of the artifacts and a discussion of their spatial relationships.

Context Analysis

The context of the artifacts associated with the Early Archaic/Late Paleo-Indian occupation of the West Water Street Site will be described in this section of the report. Phase III excavation of this component was focused on Segments B and C, which are shown in Figure 3. Phase II testing of these areas indicated that artifacts were in good stratigraphic context in this deepest portion of the site, and this finding was confirmed during data recovery excavations, as was noted in the earlier description of site stratigraphy. What had not been realized during Phase II testing was that two separate artifact horizons or depositions were present in both Segments B and C of the Early Archaic/Late Paleo-Indian occupation. Each of these artifact deposits were generally thin and separated from each other by varying amounts of sterile soil. It should be noted that each artifact deposit was not represented in every excavation unit. While most units contained both deposits, some only contained the upper or lower deposit. In general, the relative depth of each deposit was consistent within each segment.

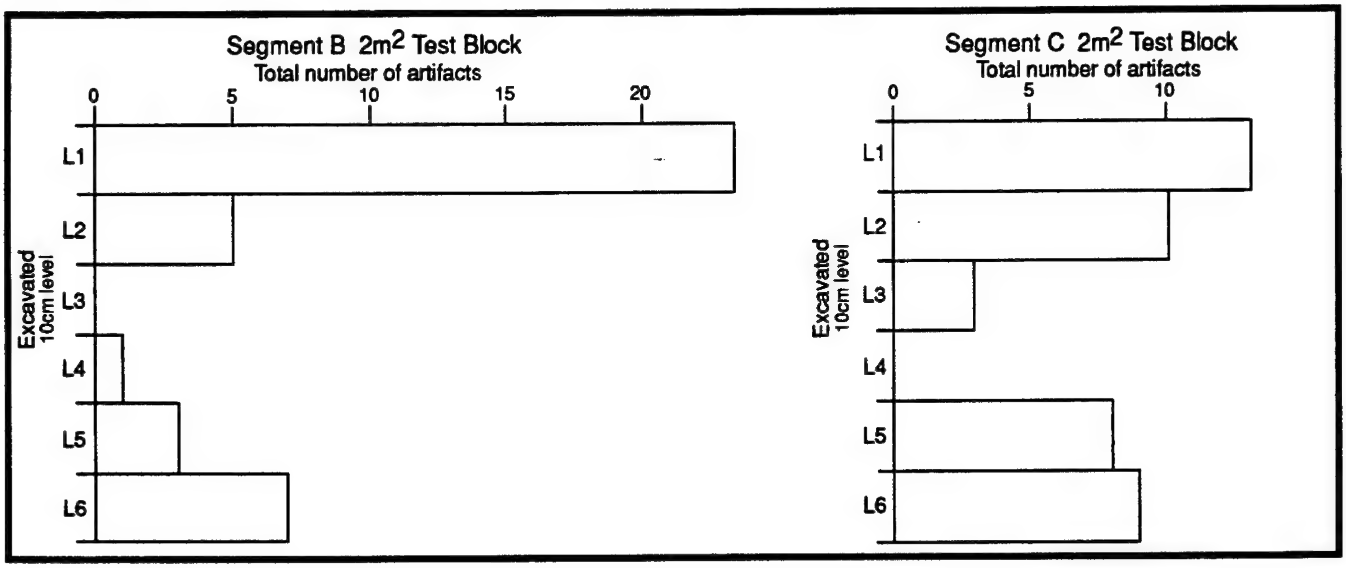
In Segment B, the upper artifact deposit was found in a 10 to 30 cm thick band which ranged from the top of the mechanically stripped surface to 30 cm below it. This band included 10 cm excavation levels 1, 2, and 3. Ten to 20 cm of sterile soil separated this upper deposit from the lower deposit, which ranged from 10 to 40 cm thick. The lower deposit included artifacts recovered from excavation levels 4, 5, and 6. Figure 116 shows the vertical distribution of artifacts in Segment B from a 2 m sq. test area. Although only a modest number of artifacts are represented, the two different artifacts deposits are clearly indicated by the two increases in artifact numbers.

In Segment C, two artifact deposits were also encountered in most of the excavation units dug there. The upper deposit in Segment C ranged from the top of the Early Archaic/Late Paleo-Indian stripped surface to 40 cm below that surface. Artifacts from this deposit were contained in excavation levels 1, 2, 3, and 4. These artifacts were separated from the lower deposit by a 10 to 20 cm thick area of sterile soil. The lower deposit was generally 10 to 20 cm thick, and included excavation levels 5, 6, and 7. Figure 116 shows the vertical distribution of artifacts from a two meter test area of Segment C. Like Segment B, a small number of artifacts are present, but two distinct artifact deposits may be recognized.

The vertical distribution of artifacts in Segments B and C shown in Figure 116 indicates that the artifacts in each individual deposit are tightly clustered within a 10 to 20 cm thick zone. The artifacts are not contained within a single 10 cm thick zone, however, so a limited amount of vertical artifact

FIGURE 116

Vertical Distribution of Early Archaic/ Late Paleo-Indian Artifacts



movement is inferred. The decrease in artifact numbers both directly above and directly below the main artifact bearing levels is suggestive of their displacement by natural processes. The extent of vertical displacement matches the empirical data on artifact displacement derived from studies of reconstructed cores (e.g. - Carr 1986; Custer and Watson 1985). The natural processes at work could include actions such as rodent and/or root disturbance, and soil freeze/thaw episodes.

As mentioned in the site stratigraphy section, no diagnostic artifacts were recovered from the upper artifact deposit in Segment B, or the lower artifact deposit in Segment C. Diagnostic Kirk/Palmer projectile points were recovered from the lower deposit in Segment B and the upper deposit in Segment C, but no other diagnostic artifacts were found with them. There is, therefore, no indication from the artifact assemblage that artifacts from earlier or later time periods are intermixed with the Early Archaic/Late Paleo-Indian occupation.

The soil profile of the Early Archaic/Late Paleo-Indian occupation has been discussed at length in the section of the report on site stratigraphy. Artifacts from the upper deposit in Segment B of this occupation were found in B and C horizons. The B horizons are well developed, which suggests that the artifacts contained in them were not rapidly buried. The length of time in which this soil was exposed is difficult to determine, however. The same case applies to the lower artifact deposit in Segment B, although these soils are more well developed. In short, the information derived from the soil profile in the Early Archaic/Late Paleo-Indian occupation of Segment B does not suggest any soil disruption or artifact movement, although it does not indicate that the artifacts were quickly buried.

TABLE 63
Summary Catalog - Early Archaic/Late Paleo-Indian Occupation, Segment B

			Upper Artifact Deposit				
Tool Type	**Chert**	**Jasper**	**Quartz**	**Rhyolite**	**Argillite**	**Quartzite/Other**	**Total**
Projectile Points	0	0	0	0	0	0	**0**
Late Stage Biface	0	0	0	0	0	0	**0**
Early Stage Biface	0	0	0	0	0	0	**0**
Cores	0	0	0	0	0	0	**0**
Flake Tools	1	1	0	0	0	0	**2**
Utilized Flakes	0	2	0	0	0	0	**2**
Flakes	61(0)	53(0)	0	0	0	6(0)	**120(0)**
Total	**62(0)**	**56(0)**	**0**	**0**	**0**	**6(0)**	**124(0)**

			Lower Artifact Deposit				
Tool Types	**Chert**	**Jasper**	**Quartz**	**Rhyolite**	**Argillite**	**Quartzite/Other**	**Total**
Projectile Points	1	0	0	0	0	0	**1**
Late Stage Biface	2	0	0	0	0	0	**2**
Early Stage Biface	6	0	0	0	0	0	**6**
Cores	1	0	0	0	0	0	**1**
Flake Tools	3	2	0	0	0	0	**5**
Utilized Flakes	2	0	0	0	0	0	**2**
Flakes	321(1)	100(0)	0	0	0	3(0)	**424(1)**
Total	**336(1)**	**102(0)**	**0**	**0**	**0**	**3(0)**	**441(1)**

Artifacts from Segment C were found in B horizons and a single A horizon. These types of soils indicate a stable soil profile, and rapid burial of these soil units. This rapid burial suggests that the artifacts found within them are from an intact context, although the presence of gravel in the upper deposit of Segment C may indicate that some artifact displacement has taken place. As was the case in Segment B, however, the length of exposure of the artifact bearing soils cannot be determined.

Even though the evidence from the soil profiles of the Early Archaic/Late Paleo-Indian occupation does not clearly indicate that the artifacts are undisturbed, their tight vertical clustering suggests that they are, in general, from a good stratigraphic context. For the purposes of analysis, the artifacts from the excavated levels within each artifact deposit have been combined, and each of the four artifact deposits will be considered separately.

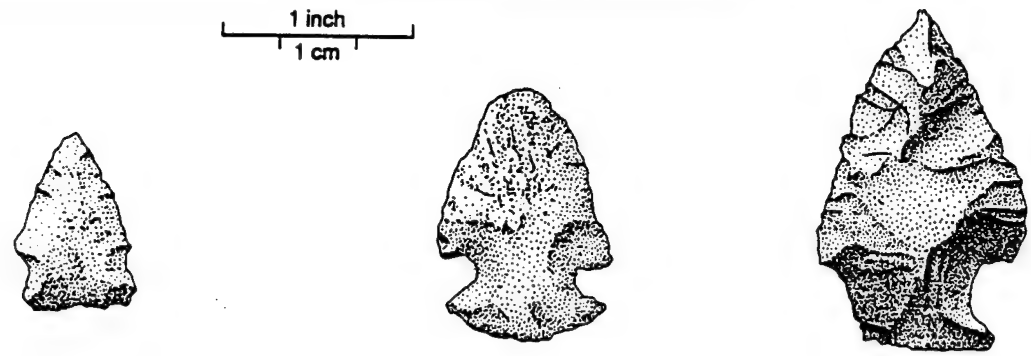
Chronology

Projectile points and a single radiocarbon date from Phase II investigations are the main sources of chronological data for the Early Archaic/Late Paleo-Indian occupation of the West Water Street Site. Each of these data sources is described below.

Projectile Points. Three projectile points were recovered from the Early Archaic/Late Paleo-Indian occupation. All of these points are corner-notched specimens that are similar to Kirk/Palmer varieties. One of these points was recovered from the lower artifact deposit of Segment B, and the other two were found in the upper artifact deposit of Segment C. No diagnostic artifacts were found in the upper deposit of Segment B or the

FIGURE 117

Projectile Points from the Early Archaic/Late Paleo-Indian Component



Segment B
Lower Deposit

Segment C
Upper Deposit

Segment C
Upper Deposit

TABLE 64

Summary Catalog - Early Archaic/Late Paleo-Indian Occupation, Segment C

Upper Artifact Deposit

Tool Types	Chert	Jasper	Quartz	Rhyolite	Argillite	Quartzite/Other	Total
Projectile Points	2	0	0	0	0	0	2
Late Stage Bifaces	1	0	0	0	0	0	1
Early Stage Bifaces	1	0	0	0	0	0	1
Cores	2	0	0	0	0	0	2
Flake Tools	11	3	0	0	0	0	14
Utilized Flakes	11	1	0	0	0	0	12
Flakes	148(1)	17(0)	0	0	0	4(0)	169(1)
Total	176(1)	21(0)	0	0	0	4(0)	201(1)

Lower Artifact Deposit

Tools Types	Chert	Jasper	Quartz	Rhyolite	Argillite	Quartzite/Other	Total
Projectile Points	0	0	0	0	0	0	0
Late Stage Bifaces	0	0	0	0	0	0	0
Early Stage Bifaces	1	0	0	0	0	0	1
Cores	0	0	0	0	0	0	0
Flake Tools	1	4	0	0	0	0	5
Utilized Flakes	3	3	0	0	0	0	6
Flakes	31(0)	65(1)	0	0	0	1(0)	97(1)
Total	36(0)	72(1)	0	0	0	1(0)	109(1)

lower deposit of Segment C. As discussed in the section of the report on site context, the deposits in which these points were found, and the deposits directly above and below them, are thought to be intact. They are clearly separated from the Middle Archaic deposits above them. A summary of the projectile points from both segments is given in Tables 63 and 64, and the points are illustrated in Figure 117.

Kirk Corner-Notched projectile points have been dated at the St. Albans site in West Virginia from 7900 B.C. to 6900 B.C., and in New York to 7410 B.C. (Broyles 1966:19-21, 40; Funk and Wellman 1984). Palmer projectile points have an slightly earlier but overlapping date range (Coe 1964; Broyles 1971). A date of 7410 ± 120 B.C. was recorded for Palmer points at the Richmond Hill site in New York (Ritchie and Funk 1973:39). Therefore, the general time range of 8000 B.C. to 7000 B.C. is suggested for these projectile points.

Radiocarbon Dates. No features or hearths were encountered during excavation of the Early Archaic/Late Paleo-Indian component of the West Water Street Site; therefore, no conventional sources of charcoal or other organic material were available for radiocarbon dating. However, samples of charcoal were recovered from flotation samples from three areas of the Early Archaic/Late Paleo-Indian occupation. None of these samples were suitable for paleo-botanical analysis. A sample was recovered from the upper artifact deposit of Segment B, and a sample was recovered from each of the deposits in Segment C. These samples were submitted to Beta Analytic, Inc. for dating. After pretreatment, all three samples were found to be too small for accurate testing.

A radiocarbon date was obtained from the Early Archaic/Late Paleo-Indian occupation during Phase II testing (Watson et al. 1992). This date was 9430 ± 310 B.P., uncorrected (Beta-53664), and came from what was found during Phase III testing to be the lower artifact deposit in Segment B. This date is compatible with the date ranges for Kirk/Palmer points in Eastern North America, and can be viewed as a valid date for the lower artifact deposit in Segment B.

The dates for the upper artifact deposit in Segment B and the lower deposit in Segment C are more problematic. The upper deposit in Segment B is separated from the Middle Archaic occupation above it, and is also separated from the dated Early Archaic/Late Paleo-Indian directly below it. A date range of 8000 B.C. to 6500 B.C. may therefore be inferred. As was discussed in the section on site stratigraphy, information from soil profiles of this segment indicate that the soils between the two artifact concentrations were deposited over a relatively short time interval. The relevant time frame for soil studies of this type span decades and centuries, however, so a more specific time frame for the upper deposit is not possible from this data.

The same situation applies to the lower artifact deposit in Segment C. These artifacts are located below soils containing Kirk/Palmer projectile points, so their stratigraphic position implies a minimum age of ca. 8000 B.C. Although information from the soil profile indicates a rapid burial of these artifact bearing soils, a more exact time frame cannot be inferred.

Analysis of Artifact Spatial Distributions

Phase III excavations of the Early Archaic/Late Paleo-Indian component of the West Water Street Site were geared towards addressing many of the same research issues as those that pertained to the Middle Archaic occupation of the site. One of the goals was to determine whether the Early Archaic/Late Paleo-Indian occupation represented a single occupation by a large group of people, or a series of small occupations by different groups. Therefore, data recovery excavations were focused on the excavation of contiguous blocks in order to study the spatial distribution of artifacts. The distribution of artifacts provides information on the size and number of occupations present.

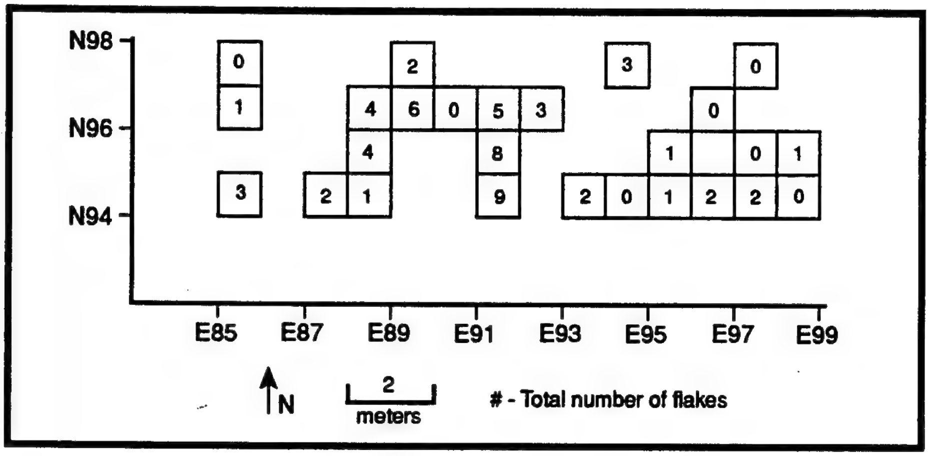
During the course of excavation of the Early Archaic/Late Paleo-Indian component, it became apparent that what was originally thought to be a single artifact bearing deposit in this part of the site was in fact four separate artifact deposits or occupations. Excavation strategies were modified as a result of this discovery, with a consequent reduction of the horizontal exposure given to each of the artifact deposits. In addition, the actual numbers of artifacts recovered from each of the four deposits were, with one exception, quite low. As a result, information on the spatial distribution of artifacts in this component of the site is limited.

As mentioned in the section of the report on the analysis of Middle Archaic artifact spatial distributions, some expectations may be generated regarding the attributes of the occupations. If any of the occupations of this component were a large macro-band base camp, distinct habitation, processing, and tool production areas should be present, without multiple occurrences of similar activity areas. On the other hand, individual social group occupations should show compact distributions of combinations of activity areas. In addition, the types of tools found at the site should provide information on the nature of the occupations. Large base camp occupations are expected to contain a wide variety of tool types, while smaller special purpose camps would exhibit a more limited assortment. Tables 63 and 64 show summary catalogs of Early Archaic/Late Paleo-Indian artifacts from each segment and Table 65 shows the counts of Early Archaic/Late Paleo-Indian tool types for each segment. The number of different types of tools present are limited, especially as compared to the Middle Archaic occupation, and more resemble a special function occupation. Also, no features of any kind were encountered in any of the Early Archaic/Late Paleo-Indian occupations. The only data available on the spatial arrangements

TABLE 65
Early Archaic/Late Paleo-Indian Tool Types

Tool Type	Segment B Upper Deposit	Segment B Lower Deposit	Segment C Upper Deposit	Segment C Lower Deposit	Total
Points/Knives	0	1	2	0	**3**
Late Stage Biface	0	2	1	0	**3**
Early Stage Biface	0	6	1	1	**8**
Primary Cores	0	1	2	0	**3**
Secondary Cores	0	0	0	0	**0**
Drills	0	0	0	0	**0**
Concave/Biconcave Scrapers	0	0	0	0	**0**
Bifacial Side Scrapers	0	1	0	1	**2**
Unifacial Side Scrapers	0	0	5	2	**7**
Trianguloid End Scrapers	0	0	1	0	**1**
Slug-Shaped Unifaces	0	0	0	0	**0**
Wedges	0	1	1	0	**2**
Denticulates	0	0	0	0	**0**
Gravers	0	0	0	0	**0**
Multi-purpose Tools	1	1	6	2	**10**
Bifacially-worked Flake Knives	1	0	0	0	**1**
Regular Utilized Flakes	2	2	11	5	**20**
Blade-like Utilized Flakes	0	0	1	1	**2**
Total	**4**	**15**	**31**	**12**	**62**

FIGURE 118
Early Archaic/Late Paleo-Indian - Segment B Chert Debitage Distribution Upper Deposit



within the various artifact deposits are the artifact distributions.

Segment B. Figures 118 - 121 show the horizontal distribution of chert and jasper flakes for the upper and lower artifact deposits of the Early Archaic/Late Paleo-Indian occupation in Segment B. Since debitage made up such a large portion of the total number of artifacts from this segment, no separate distribution maps showing total artifacts were made. Tools from Segment B fall within the same areas as flakes. No concentrations are discernible in the upper portion of Segment B

FIGURE 119

Early Archaic/Late Paleo-Indian - Segment B Jasper Debitage Distribution Upper Deposit

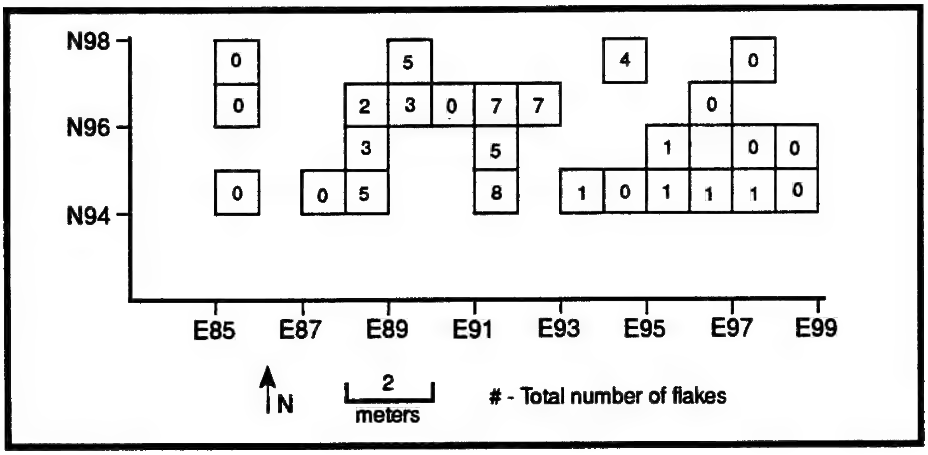
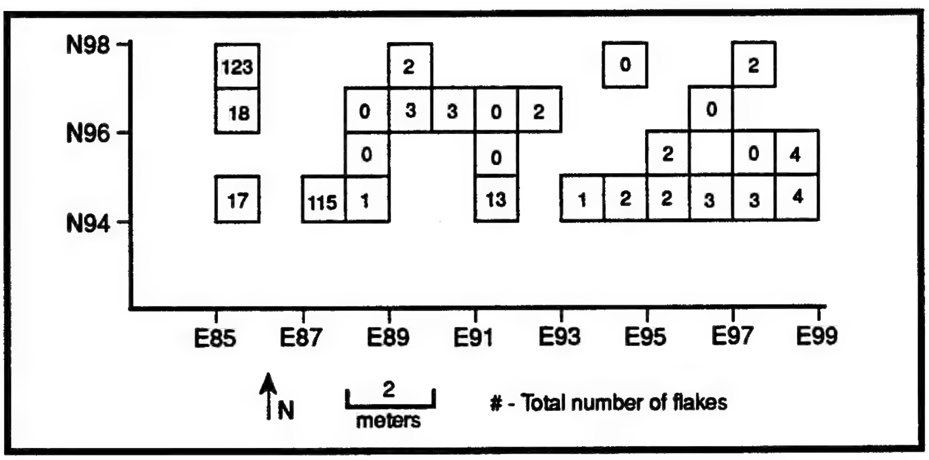


FIGURE 120

Early Archaic/Late Paleo-Indian - Segment B Chert Debitage Distribution Lower Deposit



for either jasper or chert flakes. In the lower deposit, a significant number of chert flakes are located in the western portion of the area, specifically in excavation units N97E85 and N94E87 (Figure 120). Jasper flakes are also concentrated in N94E87 (Figure 121). Given the small number of artifacts found in the upper artifact deposit of Segment B, little can be said regarding spatial patterning. Although horizontal exposure is limited, the tight clustering of artifacts in the lower deposit of Segment B is suggestive of individual family occupations.

FIGURE 121

Early Archaic/Late Paleo-Indian - Segment B Jasper Debitage Distribution Lower Deposit

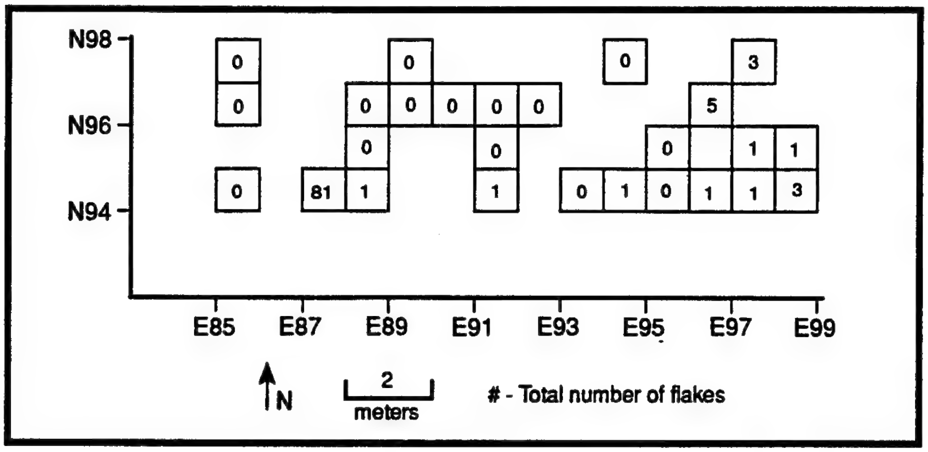
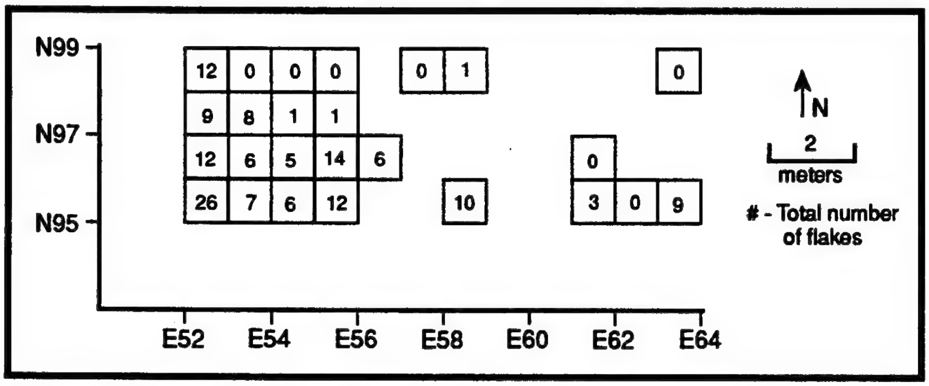


FIGURE 122

Early Archaic/Late Paleo-Indian - Segment C Chert Debitage Distribution Upper Deposit



<u>Segment</u> <u>C</u>. Figures 122 - 125 show the distribution of chert and jasper flakes for both artifact deposits of Segment C. As in Segment B, debitage is by far the largest artifact type, so no other distribution maps were created. Tools in Segment C fell within the same area as debitage. No clear artifact clusters are discernible in the upper deposit of Segment C, except for a generally higher artifact density in the western portion of the segment. The small number of artifacts in the upper deposit of Segment C makes any inferences on artifact spatial analysis difficult. In the lower deposit of Segment C, a modest clustering of jasper flakes may be seen along the western edge of the area. Once again, the total numbers of artifacts are low, and this cluster may represent a single episode of biface reduction in this location.

FIGURE 123

Early Archaic/Late Paleo-Indian - Segment C Jasper Debitage Distribution Upper Deposit

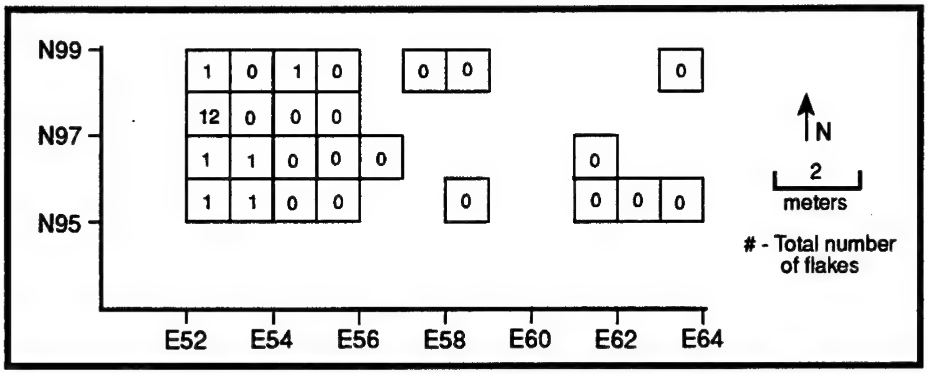


FIGURE 124

Early Archaic/Late Paleo-Indian - Segment C Chert Debitage Distribution Lower Deposit

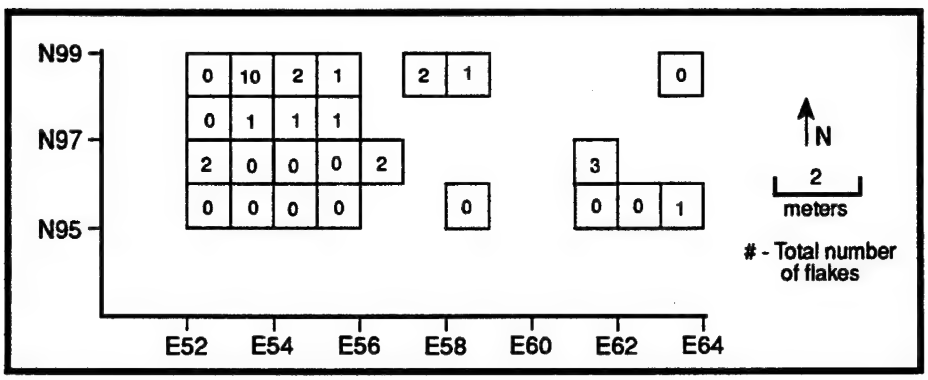
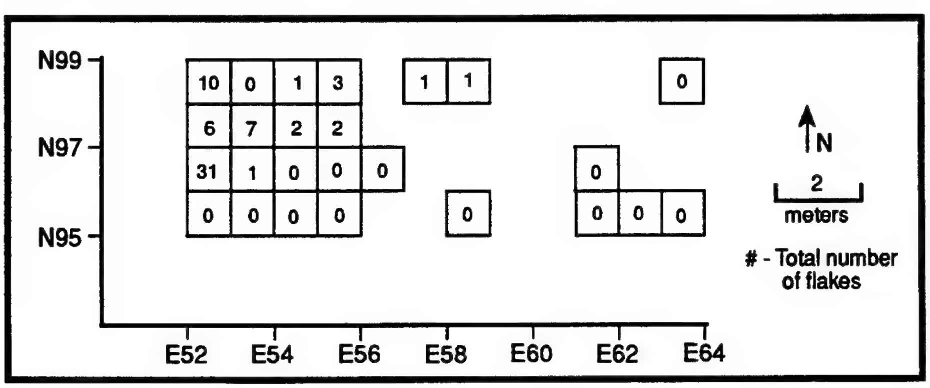


FIGURE 125

Early Archaic/Late Paleo-Indian - Segment C Jasper Debitage Distribution Lower Deposit



Discussion. Only one clearly definable artifact cluster was identifiable in all of the Early Archaic/Late Paleo-Indian occupation areas in Segments B and C. The low number of artifacts present makes analysis difficult, but the single cluster in the lower portion of Segment B is like those associated with individual social group occupations. However, this is only a single example, and the absence of multiple clusters does not argue for multiple group occupations. The absence of additional artifact clusters may, however, be a function of the limited amount of horizontal exposure obtained in each segment. No distinctive habitation, processing, or tool production areas were identified, which is more indicative of small social group occupation. This patterning may also be a function of the limited amount of horizontal exposure. There is no indication of more than one occupation in each artifact deposit in either of the segments. The small number of artifacts and the absence of more than one artifact cluster per artifact deposit does not enable any insights on the time interval represented by each occupation.

Lithic Artifact Analysis

The lithic raw materials present in the Early Archaic/Late Paleo-Indian component were almost exclusively composed of cryptocrystalline cherts and jaspers (Tables 63 and 64). Chert is found locally in primary outcrops, while the closest sources for jasper are in central Pennsylvania near Houserville and in eastern Pennsylvania in Berks and Lehigh Counties. Locally available jaspers may be found in cobble form along the West Branch of the Susquehanna and its tributaries, but the absence of cobble cortex on the jasper debitage in the Early Archaic/Late Paleo-Indian artifact assemblage indicates that it was from a primary source. The raw materials present at the site most likely represent the lithic materials groups had with them when they arrived in the Lock Haven area. The presence of primary jasper suggests that these groups had traveled as far as central Pennsylvania before arriving at the West Water Street Site.

The Early Archaic/Late Paleo-Indian artifact assemblage from the West Water Street Site consisted of Kirk/Palmer projectile points, early and late stage bifaces, cores, flake tools and utilized flakes, a miscellaneous stone tool, and debitage. These artifacts are listed by raw material type in summary catalogs (Tables 63 and 64). Tools are listed in Table 65 by more specific tool types with tools of all raw material types combined. These tables list the artifacts by segments and deposits within the segments. Projectile points are illustrated in Figure 117 and examples of tools from the Early Archaic/Late Paleo-Indian assemblage are illustrated in Figure 126. As Tables 63 and 64 note, the tools of the Early Archaic/Late Paleo-Indian assemblage were produced exclusively from chert (75%) and jasper (25%). These percentages roughly correspond with the percentages of chert and jasper debitage found during test unit excavations of the Early Archaic/Late Paleo-Indian deposits of Segments B and C and indicate a preference for high quality cryptocrystalline

materials for tool manufacture. In contrast to the Middle Archaic component of the West Water Street Site, no non-cryptocrystalline tools were found in the deposits of the Early Archaic/Late Paleo-Indian component.

Projectile Points. Three Kirk/Palmer projectile points were recovered during test unit excavations of the Early Archaic/Late Paleo-Indian deposits in Segments B and C. These points are listed in Tables 63, 64, and 65. These included one chert Kirk/Palmer point from the lower deposit of Segment B and two chert Kirk/Palmer points from the upper deposit of Segment C (Figure 117).

Unfortunately, the sample size of diagnostic points from the Early Archaic/Late Paleo-Indian component of the West Water Street Site is too small to be meaningfully compared to assemblages from other Early Archaic/Late Paleo-Indian sites. However, these points do fit in well with the uncorrected carbon date of 7480 ± 310 B.C. (Beta-53664) ascribed to the lower Early Archaic/Late Paleo-Indian deposit of Segment B. The points show resharpening, repairing, and reworking (Figure 117) indicating a curated, multi-purpose tool kit.

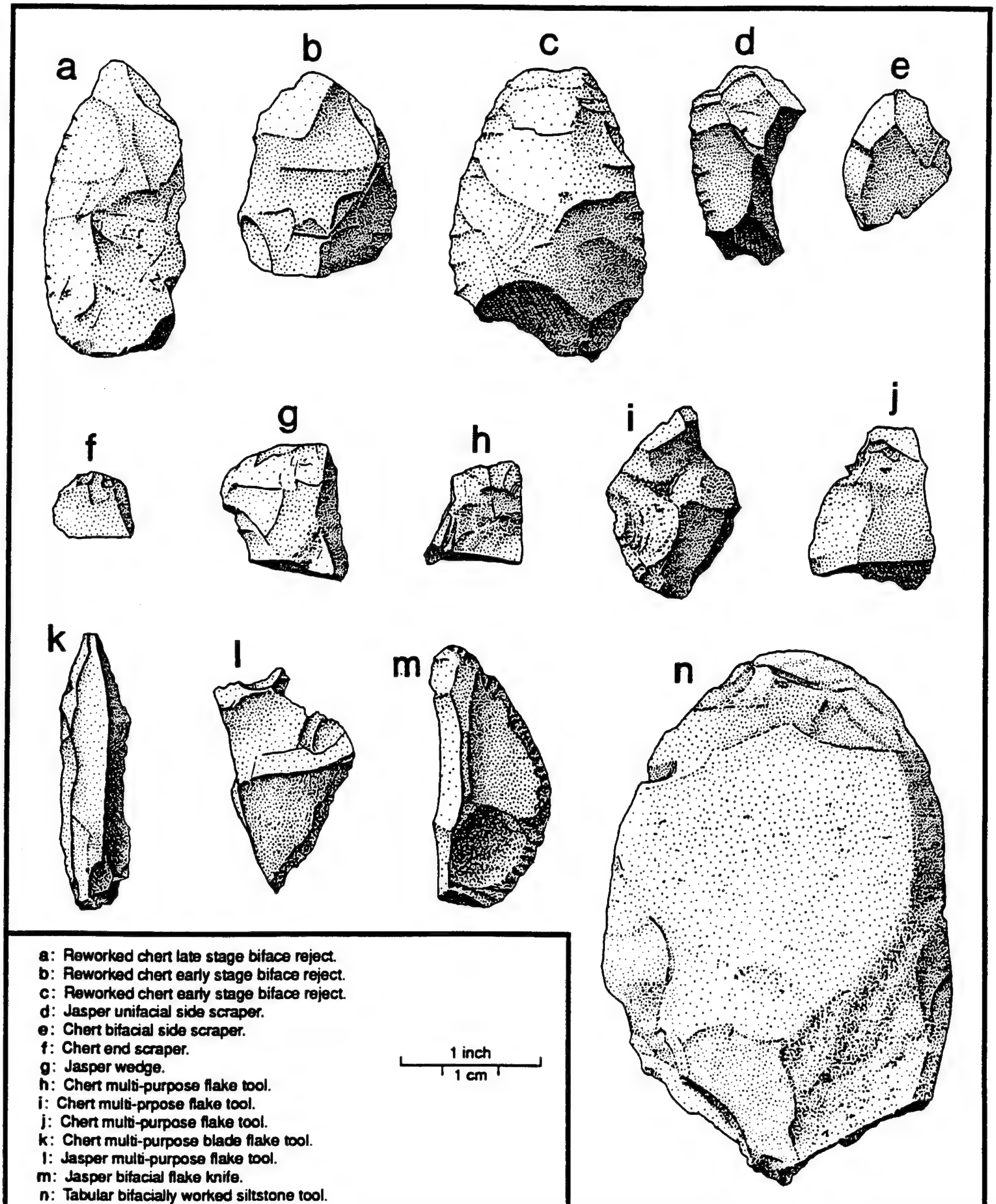
Bifaces. Summary catalogs (Tables 63 and 64) list bifaces from each segment and deposit of the Early Archaic/Late Paleo-Indian component of the West Water Street Site. Two late stage bifaces were found in the lower Early Archaic/Late Paleo-Indian deposit of Segment B. None were recovered from the upper deposit. Both late stage bifaces from the lower deposit were fragmentary and both were made from chert. One of the fragments appeared to be a proximal fragment from the hafting element of a projectile point. The fragment consisted of what appears to be a flattened base and the remnant of a corner notch. The fragment had multiple fractures and measured only 9 mm by 11 mm. The other late stage biface from Segment B was a fragment of chert bifacial knife. This fragment was also very small and appeared to have been broken during resharpening. After the knife was broken, however, it was reused, as evidenced by the use wear along one of the fracture edges.

Although no late stage bifaces were found in the lower Early Archaic/Late Paleo-Indian deposit of Segment C, one was recovered from the upper deposit. This biface (Figure 126a), was made from chert, but due to material flaws, it could not be effectively reduced into a projectile point. However, one lateral edge was reworked into a bifacial cutting tool or knife. The knife edge extended from near the distal end to half way around the base, which had no hafting element. This biface was further worked on the opposing edge into a scraping tool, thus creating a multipurpose tool.

No early stage bifaces were found in the upper Early Archaic/Late Paleo-Indian deposit in Segment B; however, six were recovered from the lower deposit. All six of these bifaces were made from chert and were rejected for a number of reasons

FIGURE 126

Sample Bifaces and Flake Tools from Early Archaic/Late Paleo-Indian Component



a: Reworked chert late stage biface reject.
b: Reworked chert early stage biface reject.
c: Reworked chert early stage biface reject.
d: Jasper unifacial side scraper.
e: Chert bifacial side scraper.
f: Chert end scraper.
g: Jasper wedge.
h: Chert multi-purpose flake tool.
i: Chert multi-prpose flake tool.
j: Chert multi-purpose flake tool.
k: Chert multi-purpose blade flake tool.
l: Jasper multi-purpose flake tool.
m: Jasper bifacial flake knife.
n: Tabular bifacially worked siltstone tool.

including material flaws, manufacturing errors, and irreducible thickness. Four of these bifaces showed signs of reworking and reuse after they were no longer suitable for further reduction. One biface showed signs of utilization wear on one edge, but three had been reworked into bifacial cutting tools and unifacial scraping tools. An example of one of these bifaces is illustrated in Figure 126b. The scraping elements on these reworked bifaces included side and concave working edges. All the early stage bifaces from the lower deposit were produced from chert, most likely from a primary source.

Two early stage bifaces were found in Segment C: one from each artifact bearing deposit. The biface from the upper deposit was made from chert and had been reworked into a multi-function tool. Several edges on this biface had been either unifacially reworked or bifacially reworked into scraping or cutting edges. The early stage biface recovered from the lower deposit is illustrated in Figure 126c. This biface was produced from a large chert flake and was rejected for further reduction when the biface was broken in a vain attempt to reduce its thickness. The biface, however, was not discarded at this point. Both lateral edges were retouched, one unifacially and one bifacially, thus creating a multi-purpose scraping and cutting tool.

It is interesting to note that six of the eight early stage bifaces were reworked into tools upon their rejection as reducible bifaces. This reworking of the tools again reflects the highly curated tool kits associated with highly mobile hunting and gathering bands of this period. Unfortunately, due to the small number of bifaces and the fragmentary nature of the bifaces in the assemblage, little can be stated about the biface reduction sequence or inter-segment comparisons. However, the predominance of high quality, primary source cherts, most likely procured from local upland settings in the immediate vicinity of the site, indicates a preference of cryptocrystalline materials and the utilization of local raw material resources by Early Archaic peoples.

<u>Flake</u> <u>Tools</u> <u>and</u> <u>Utilized</u> <u>Flakes</u>. A variety of flake tools and utilized flakes were recovered from the Early Archaic/Late Paleo-Indian deposits of the West Water Street Site. These are listed in the summary catalogs (Tables 63 and 64) and by specific tool types in Table 65. Several flake tools are illustrated in Figure 126, including a unifacial side scraper (126d), a bifacial side scraper (126e), an end scraper (126f), a wedge (126g), five multi-purpose flake tools (126h-l), and a jasper flake knife (126m).

Two multi-purpose flake tools were recovered from Segment B, one from each Early Archaic/Late Paleo-Indian artifact bearing deposit. The multi-purpose flake tool from the upper deposit combined a bifacial cutting edge with a unifacial, concave side scraping edge (Figure 126h). The multi-purpose flake tool from the lower artifact deposit combined several unifacial scraping edges with a bifacial edge and a graver element (Figure 126i).

Seven multi-purpose flake tools were recovered from Segment C, including five found in the upper artifact deposit. Three of these tools were multi-edged bifacially and unifacially worked flakes. These tools could have served both as cutting and scraping implements. Two of these tools had three or four working edges. Another multi-purpose flake tool found in the upper deposit of Segment C combined an end scraping element with a denticulate component (Figure 126j). The final multi-purpose flake tool from the upper deposit of Segment C was a reworked, chert blade flake (Figure 126k). Several areas along this tool's lateral edges showed signs of utilization. Later, it appears that the blade was reworked unifacially and bifacially in several areas. It also appears that the distal tip of the flake may have been broken off during its use as an awl as evidenced by a compression fracture on the distal end of the flake.

Two multi-purpose flake tools were recovered from the lower Early Archaic/Late Paleo-Indian deposit of Segment C. These include a jasper tool that combined side and concave scraping elements with a denticulate component. Also included was a jasper tool that combined a unifacial side scraping element with a graver element (Figure 126l).

Again, due to the small number of tools in the Early Archaic/Late Paleo-Indian assemblage, comparisons between the tool assemblages of the four deposits of Segments B and C are difficult. Also, the lack of significant numbers of formal tool types makes inter-site comparisons less meaningful. However, the Early Archaic/Late Paleo-Indian tool assemblage does corroborate Lowery and Custer's (1990) contention that so-called "diagnostic" Early and Middle Paleo-Indian period tool forms (e.g.- Gramly and Lothrop 1984) can also be found in Early Archaic assemblages. The presence of a large proportion of multi-purpose flake tools, along with the reworked bifaces, does indicate that the Early Archaic/ Late Paleo-Indian occupants of this site possessed highly curated tool kits which are characteristic of mobile hunter/gatherer bands.

<u>Cores</u>. Only three chert cores were recovered during Early Archaic/ Late Paleo-Indian test unit excavations in Segments B and C (Tables 63, 64, 65). These include one core from the lower deposit of Segment B and two cores found in the upper deposit of Segment C. The core from Segment B appeared to have been worked in a bipolar fashion. One core from Segment C showed signs of retouch and utilization along one edge. Two of the cores were produced from primary materials, but the bipolar core showed signs of cobble cortex, indicating its secondary nature.

<u>Miscellaneous Stone Tools</u>. No hammerstones, anvils, or net weights were found during Early Archaic/Late Paleo-Indian test unit excavations in Segments B and C. However, one bifacially worked, tabular siltstone tool, or "teshoa" (Kraft 1975), illustrated in Figure 126n, was recovered from the upper deposit

of Segment C. This tool was worked almost continuously around its entire edge surface. The edges of the tool appeared to have been dulled or blunted from use, perhaps as a cutting or chopping implement. Similar tools were found during excavations of the Middle Archaic component of the West Water Street Site.

Debitage. A total of 810 pieces of debitage were recovered from the Early Archaic/Late Paleo-Indian component of the West Water Street Site. Tables 63 and 64 show the totals of flakes by raw material type and segment/deposit. As these tables indicate, the majority of debitage was chert (69%). Jasper flakes accounted for 29% of the total debitage for all deposits combined. However, jasper was the predominant raw material type in the lower deposit of Segment C. This observation is particularly interesting when one considers that this is the only occupation at the West Water Street Site where chert was not the most prevalent lithic raw material. This observation may be a reflection of the lithic preferences of the inhabitants of this occupation, or it may indicate that the group had most recently been to a jasper quarry and had not yet replenished their tool kits with locally available cherts. It is also possible that this anomaly is the result of small sample size and may not be an accurate reflection of the actual raw material percentages. The remaining two percent of the total sample were quartzite flakes. Raw material percentages for debitage are consistent with the patterns observed for other artifact types. It is interesting to note the complete absence of argillite and rhyolite. These raw materials do not become popular until the end of the Early Archaic period and into the Middle Archaic period (Custer 1989).

A sample of 50 flakes was analyzed for flake attributes using the same methods used for the analysis of debitage from the Middle and Late Archaic components. Table 66 lists the flake attribute percentage data and analysis for the Early Archaic/Late Paleo-Indian component of Segment B (lower deposit). The total number of flakes from each of the other three artifact deposits were too low for meaningful analysis. As discussed previously, not all attributes are equally useful in determining core versus biface reduction. However, several attributes such as flake type, platform shape, remnant biface edge, and the presence or absence of platform preparation are very useful in making this determination. The data concerning these four attributes clearly indicate that core reduction was more common than biface reduction. Conversely, the data concerning flake size, scar count, and scar directions seem to indicate biface reduction. Nonetheless, given the varying degrees of usefulness of the variables, it appears that core reduction was the most prevalent lithic reduction activity. This core reduction may reflect the processing of locally available, primary source raw materials and may also be an indication of expedient flake tool production as noted for the Middle Archaic component of this site.

TABLE 66
Early Archaic/Late Paleo-Indian Flake Attribute Data and Analysis

	Biface Control	Core Control	Segment B Lower Deposit	Analysis
Flake Type				
Complete	12	63	74	Core
Proximal	28	19	6	
Medial	26	4	8	
Distal	35	14	12	
Size				
Small	78	49	80	
Medium	20	46	16	Biface
Large	2	5	4	
Platform Shape*				
Triangular	81	10	5	
Flat	7	37	24	Core
Round	12	35	71	
Remnant Biface Edge*				
Present	19	3	12	Core
Absent	81	97	88	
Platform Preparation*				
Present	88	10	17	Core
Absent	12	72	83	
Scar Count				
Mean	2	1	3	Biface
Standard Deviation	1	1	1	
Scar Direction Counts				
Mean	2	1	3	Biface
Standard Deviation	1	1	1	

*Most critical discriminating attribute

Discussion

Information derived from the excavations of the Early Archaic/Late Paleo-Indian occupation of the West Water Street Site provided important insights into the Late Pleistocene/Early Holocene occupation of the West Branch Valley. The information is particularly enlightening when compared to earlier and later cultural periods both in central Pennsylvania and the Middle Atlantic region in general.

An analysis of the debitage from one of the Early Archaic/Late Paleo-Indian occupations at the site suggested that the reduction of cores was the main lithic reduction activity, with some biface reduction also taking place. Other research in the Middle Atlantic region has shown that some Early Archaic sites show a heavy reliance on the careful reduction of bifaces, while others focus on a more haphazard reduction of cores to produce flakes (Lowery and Custer 1990). In this sense, the West Water Street Site resembles the Fifty Site, an Early Archaic hunting/processing site in the Shenandoah Valley of Virginia, were the reduction of cores was the main tool production activity (Carr 1975, 1986). The two sites are also similar in that they are both within close proximity to sources of high quality

cryptocrystalline lithic material. This core reduction supports the contention that Early Archaic/Late Paleo-Indian groups living near lithic sources will show less careful curation of their tool kits and a more profligate use of lithic raw materials (Lowery and Custer 1990:103).

The pattern of lithic resource use described above has been associated with the cyclical movement of Early Archaic/Late Paleo-Indian peoples between high quality lithic sources and other areas more favorable to hunting and food gathering (Custer 1989:108-109; Lowery 1989:161-162). This movement of Early Archaic/Late Paleo-Indian groups between lithic and food sources may be broken down into three stages. Groups arrive at high quality lithic quarries and discard exhausted tools while replenishing their tool kits with transportable bifaces. Next, the groups move into productive resource areas away from the quarries, using and reducing their bifaces with an increasing level of curation. Finally, movements are scheduled so that the group returns to the quarry as the tool kit nears exhaustion, and the cycle is repeated. At the West Water Street Site, the majority of bifaces and tools found had been heavily reworked, and probably represent tools that were discarded at the site while new tools were being produced from local cherts. In addition, cores were being reduced to produce expedient flakes to be used while at the site.

In the Delmarva Peninsula, the procurement of high quality lithic material during the Early Archaic/Late Paleo-Indian period is thought to have focused on one source of primary lithic material (Lowery and Custer 1990). Such may be the case with the inhabitants of the West Water Street Site, with scheduled trips always returning to the local chert outcrops. The presence of jasper debitage, however, may be an indication that scheduled quarry trips were alternated between the eastern Pennsylvania jasper outcrops and the central Pennsylvania chert sources. The location of the eastern jasper sources is well within the hypothesized wandering ranges of Early Archaic/Late Paleo-Indian groups (Custer n.d.a:149). Although information is scant, there is some evidence of Early Archaic/Late Paleo-Indian use of the eastern Pennsylvania jasper quarries (Custer n.d.a:178). In the Delmarva Peninsula and New Jersey, Early Paleo-Indian lithic use shows a preference for jasper, while information from the Susquehanna River Valley shows a higher incidence in the use of cherts and has lithic use patterns more like areas to the north (Custer n.d.a:181). Although information on lithic use in the Early Archaic/Late Paleo-Indian Period is not as well known, the West Water Street Site, with the presence of both jasper and chert, may reflect lithic use in a transitional zone between predominately jasper-using areas to the east and chert-using areas to the north.

Tools recovered from the Early Archaic/Late Paleo-Indian excavations resemble those known from other sites of this time period (Custer n.d.a:146). The points, bifaces and variety of flake tools reflect the generalized adaption of Early

Archaic/Late Paleo-Indian peoples who exploited a wide range of hunted and gathered resources. Although the exploitation of plant resources was becoming more important in the beginning of the Holocene, no plant processing tools were recovered from the site. The absence of plant processing tools is typical of many sites from this time period, with the full-blown emergence of plant processing tools coming later in the Middle Archaic period. Although the variety of tool types found in the Early Archaic/Late Paleo-Indian occupation of the site was limited, they show some characteristics of traditional Paleo-Indian tool assemblages. This similarity reinforces the conclusion, made elsewhere in this report, that a large degree of continuity in lithic technology is evident from Paleo-Indian through Early Archaic times, and even into the Middle Archaic Period.

The floodplain of the West Branch of the Susquehanna River would have been a highly productive resource zone during the Late Pleistocene and Early Holocene. The use of floodplains by prehistoric groups at this time has been documented along the Delaware River at the Shawnee Minisink Site, and is thought to relate to the increasing spread of boreal forests in upland areas (Custer n.d.a:157). The spread of these resource-poor forests would have made the floodplains, with more deciduous growth and concomitant resources, a more attractive locale. The Early Archaic/Late Paleo-Indian occupation of the West Water Street Site documents the use of these locales.

CONCLUSIONS

Throughout this report we have provided summary remarks and discussions of regional research issues as they pertain to the archaeological data gathered from each of the individual components of the West Water Street Site. We will not reiterate those comments here; however, some concluding remarks on the data from the Phase III excavations are in order. Probably the most important point to note is the fact the data recovery excavations did indeed recover vast amounts of important archaeological data on the prehistoric inhabitants of the West Branch Valley of the Susquehanna River. Although the context of the data ranged from excellent, as was the case for the Early and Middle Archaic components, to poor, as was the case for the Late Archaic through Contact components, important data on all of the archaeological components were recovered.

The work of Turnbaugh (1977) provides a regional context for the interpretation of the data from the West Water Street Site and his work has been referenced extensively throughout this report. However, it is also useful to explicitly consider the broader links between the West Water Street Site data and his synthesis of local culture history. In discussion of the Early and Middle Archaic Periods, Turnbaugh (1977:89-98) makes use of a variety of projectile point typological studies from other parts of Eastern North America (e.g. - Coe 1964) and feels that their application to the north central area of Pennsylvania is valid.

He also notes that local cultural historical sequences for the West Branch Valley of the Susquehanna need to be investigated in order to check the validity of the application of these typologies from other regions.

The West Water Street data do provide such a local sequence for the Early and Middle Archaic. The presence at West Water Street of Palmer, LeCroy bifurcate, and Neville/Stanly variants, which were first identified, defined, and dated in other regions, in good stratigraphic contexts that match their relative and absolute dates at other sites supports Turnbaugh's initial use of the non-local typologies. Nonetheless, the presence of the Middle Archaic triangular point also indicates that there is additional projectile point variability during these time periods that needs to be considered. The presence of projectile point forms that are quite similar to those identified in the Southeast and in New England in the West Branch Valley of the Susquehanna River would also support Dincauze's (1976:140-142) suggestion that there was a large "Atlantic Slope" culture area during the Early and Middle Archaic Periods. Within this large culture area there was probably a large amount of social interactions among individual bands to maintain the similarities observed among a series of changing projectile point styles through time (Michlovic 1976).

Turnbaugh's (1977:93-101) site distribution data for the Early and Middle Archaic Periods suggest that there were numerous repeated occupations of the floodplains of the West Branch of the Susquehanna River during these periods. The West Water Street Site provides excavated data attesting to the nature of these occupations. They were generally small campsites of individual families. The accumulations of numerous artifacts from these time periods at some local sites noted by Turnbaugh probably resulted from repeated use of certain locales over time, not the contemporaneous use of especially attractive locales by multiple social groups. Data recently gathered from the Memorial Park Site (Hart 1993b) also support this contention.

Local data on projectile point and site frequencies for these time periods also suggest that local populations grew from Paleo-Indian through Middle Archaic times (Turnbaugh 1977:97). These kinds of data are not always the best indicators of population growth, especially when they are derived from surface collection data, as is the case for the data described by Turnbaugh. Also, the site-specific data from a site like West Water Street are not always applicable to questions of regional population densities and distributions. Data from individual sites and surface survey data can be combined, however, to generate useful insights. The West Water Street Site data from the Middle Archaic occupation do show multiple occupations that were more intensive than those of the Early Archaic occupation. This difference may be a result of the placement of excavation units and sampling factors. However, the extensive Phase II testing of the site clearly shows that the Middle Archaic occupations were more extensive and more widely distributed than

those of the Early Archaic over a fairly large area. These data are not inconsistent with local population growth.

Little can be said about Late Archaic occupations of the West Water Street Site with respect to Turnbaugh's synthesis except for some general observations about the Late Archaic "Susquehanna Tradition." Turnbaugh (1977:142-152) notes the widespread distribution of this "tradition" in the West Branch Valley as exemplified by the presence of Susquehanna broadspears manufactured from rhyolite, and soapstone bowl fragments. Artifacts of this tradition were found throughout all segments of the West Water Street Site and attest to a number of different occupations of the site during the end of the Late Archaic Period. The repeated co-occurrence of the rhyolite Susquehanna broadspears and the soapstone bowls across a rather large site, and throughout the region, is of interest. Intensive trade and exchange networks, repeated and regular use of a territory including the South Mountain rhyolite quarries, or migrations of prehistoric peoples are all potential explanations of the site-specific and regional distributions of these artifacts at the end of the Late Archaic Period. Further research is needed to understand the cultural changes that took place during this prehistoric time period.

Turnbaugh (1977:208-230) notes the widespread distribution of Late Woodland Clemson Island materials in the West Branch Valley and the West Water Street Site provides yet another example of a Clemson Island site. There were clearly numerous Clemson Island occupations of the site and some were at least as substantial as fortified hamlets consisting of multiple families. It is also possible that the occupations could have been even larger. Intensive use of certain areas for specialized storage functions also implies a regularized reuse of site areas that is not seen during any other time periods.

The Late Woodland occupations of the West Water Street Site, and of other sites in the local area, are clearly very different from any of the earlier occupations. The low numbers of Early and Middle Woodland sites and artifacts in the region (Turnbaugh 1977:171-208), and at the West Water Street Site in particular, suggest that some kind of significant changes in the prehistoric populations' use of the West Branch Valley took place between ca. 500 B.C. and A.D. 1000. Furthermore, prior to Late Woodland times there seem to be significant connections between the inhabitants of the West Branch Valley and prehistoric populations living to the south and east in the lower portions of the Susquehanna Valley. During Clemson Island times, the most significant cultural interactions of inhabitants of the West Branch Valley occurred with prehistoric peoples living to the north in the circum-Great Lakes region. The pronounced change in adaptations and interaction spheres suggest some significant cultural changes and these may be related to hypothesized prehistoric migrations during this time period (Feidel 1990).

The Contact Period occupations of the West Water Street Site are rather ephemeral and scattered across the site. Their distribution would indicate small individual family occupations rather than large villages and this settlement pattern matches well with the regional patterns noted by Turnbaugh (1977:241-248). These groups were highly acculturated by the time that they settled in the West Branch Valley area and their demise in the middle to late eighteenth century brings and end to the region's prehistoric archaeological record.

In conclusion, the excavations at the West Water Street Site did indeed recover significant data regarding the region's prehistory. Examples of regional trends noted by Turnbaugh (1977) were seen to be present at the site. Nonetheless, the detailed site data provide a more complete view of the variability of the local prehistoric archaeological record and the cultural adaptations of the region's prehistoric inhabitants.

REFERENCES CITED

Ahler, S.
1971 Projectile Point Form and Function at Rodger's Rock Shelter, Missouri. Missouri Archaeological Society Research Series 8. Columbia.

Adovasio, J. M., and W. C. Johnson
1981 The Appearance of Cultigens in the Upper Ohio Valley: A View from Meadowcroft Rockshelter. Pennsylvania Archaeologist 51:63-80.

Alexander, L. T.
1983 Clay Tobacco Smoking Pipes From the Caleb Pusey House. The Archaeology of the Clay Tobacco Pipe VIII. America. International Series 175. Oxford, England.

Ameringer, C.
1975 Susquehannock Plant Utilization. In Proceedings of the 1975 Middle Atlantic Archaeological Conference, edited by W. F. Kinsey, pp. 58-63. North Museum, Franklin and Marshall College, Pennsylvania.

Baker, J. A.
1980 The Economics of Weed Seed Subsistence in the Ridge and Valley Province of Central Pennsylvania. In The Fisher Farm Site: A Late Woodland Hamlet in Context, 205-22. Pennsylvania State University Department of Anthropology Occasional Papers in Anthropology, edited by J. W. Hatch, No. 12. University Park.

Bardon, L., and J. Bouyssonie
1906 Outils ecailles par percussion. Revue de l'Ecole d'Anthropologie de Paris 16:170-175.

Bartram, J.
1751 Observations on the Inhabitants, Climate, Soil, Rivers, Productions, Animals and Other Matters Worthy of Notice Made by Mr. John Bartram in his Travels from Pennsylvania to Onondaga, Oswego and Lake Ontario in Canada. Whiston and White, London.

Bender, M. M.
1968 Mass Spectrometric Studies of Carbon 13 Variations in Corn and Other Grasses. Radiocarbon 10:468-472.

1971 Variations in the $^{13}C/^{12}C$ Ratios of Plants in Relation to the Pathway of Photosynthetic Carbon Dioxide Fixation. Phytochemistry 10:1239-1244.

Benenson, C. A., and P. E. Franks
1990 Architectural Resources Overview Lock Haven Local Flood Protection Project, Clinton County, Pennsylvania. Report prepared by Kise, Franks, and Straw Historic Preservation Group for the United States Army Corps of Engineers, Baltimore District.

Binford, L. R.
1961 A New Method of Calculating Dates from Kaolin Pipestems. Southeastern Archaeological Conference Newsletter 9(1).

1967 Smudge Pits and Hide Smoking: The Use of Analogy in Archaeological Reasoning. American Antiquity 32(1):1-12.

1979 Organization and Formation Processes: Looking at Curated Technologies. Journal of Anthropological Research 35:255-273.

1983 In Pursuit of the Past. Thames and Hudson, New York.

Birkeland, D. W.
1974 Pedology, Weathering, and Geomorphological Research. Oxford University Press, New York.

Bordes, F.
1961 Typologie du Paleolithique Ancien et Moyen. Publications de l'Institute de Prehistoire de Bordeaux, Memoire No. 1. Bordeaux.

1968 The Old Stone Age. Weidenfeld and Nicolson, London.

Braidwood, R. J., and G. R. Willey
1962 Courses Toward Urban Life. Viking Fund Publications in Anthropology No. 32. Chicago.

Brennan, L. A.
1981 Pick-Up Tools, Food Bones, and Inferences on Lifeway Function of Shell Heap Sites Along the Lower Hudson. Archaeology of Eastern North America 9:42-51.

Bressler, J.
1980 Excavation of the Bull Run Site (36LY119). Pennsylvania Archaeologist 50(4):31-63.

1993 Excavation of a Shenks Ferry Habitation Complex on Canfield Island, Lycoming County, Pennslyvania. Journal of the Lycoming County Historical Society 34(1):6-15.

Bressler, J., R. Maietta, and K. Rockey
1983 Canfield Island Through the Ages (36YL37). Grit Publishing Company, Williamsport, Pennsylvania.

Broyles, B. J.
1966 Preliminary Report: The St. Albans Site (46KA27), Kanawha County, West Virginia. The West Virginia Archaeologist, No. 19, pp. 1-43. Moundsville.

1971 Second Preliminary Report: The St. Albans Site, Kanawha County, West Virginia. West Virginia Geological and Economic Survey, Report of Archaeological Investigations 3. Morgantown.

Calkin, P. E., and K. E. Miller
1977 Late Quaternary Environment and Man in Western New York. Annals of the New York Academy of Sciences 288:297-312.

Callahan, E.
1979 The Basics of Biface Knapping In the Eastern Fluted Point Tradition. Archaeology of Eastern North America 7:1-180.

Carbone, V. A.
1976 Environment and Prehistory in the Shenandoah Valley. Ph.D. dissertation, Catholic University of America, Washington, D.C.

1977 Phytoliths as Paleoecological Indicators. Annals of the New York Academy of Sciences 288:194-205.

Carr, K. W.
1975 The Fifty Site: A Flint Run Paleo-Indian Complex Processing Station. Master's thesis, Department of Anthropology, Catholic University of America, Washington, D.C.

1986 Core Reconstruction and Community Patterning at the Fifty Site. Journal of Middle Atlantic Archaeology 2:79-92.

Cavallo, J. A.
1981 Turkey Swamp: A Late Paleo-Indian Site in New Jersey's Coastal PLain. Archaeology of Eastern North America 9:1-18.

1987 Abbott Farm, Area B (28ME1-B): Archaeological Data Recovery. Federal Highway Administration and New Jersey Department of Transportation, Trenton.

Chapman, J.
1975 The Rose Island Site. University of Tennessee Department of Anthropology Report of Investigations 14. Knoxville.

Childe, V. G.
1928 The Most Ancient East. Oxford.

Cleland, C.
1972 From Sacred to Profane: Style Drift in the Decoration of Jesuit Finger Rings. American Antiquity 37(2):202-210.

Coe, J. L.
1964 Formative Cultures of the Carolina Piedmont. Transactions of the American Philosophical Society NS 54(5).

Cohen, J. A., T. W. Neumann, and S. Hinks
1989 Phase II Intensive Survey of Historic and Prehistoric Components at the Packer Site (36CN79), Clinton County, Pennsylvania. Report prepared by R. Christopher Goodwin and Associates, Inc. for the United States Army Corps of Engineers, Baltimore District.

Cook, F., and R. F. Heizer
1968 Relationships Among Houses, Settlement Areas, and Population in Aboriginal California. In Settlement Archaeology, edited by K. C. Chang, pp. 79-116. National Press Books, Palo Alto, California.

Cook, T. G.
1976 Koster: An Artifact Analysis of Two Archaic Phases in Westcentral Illinois, Northwestern University Archaeological Program, Prehistoric Records No. 1. Evanston, Illinois.

Cordell, L.
1984 Prehistory of the Southwest. Academic Press, New York.

Cowan, V.
1991 The Middle Archaic in the Upper Ohio Valley. Journal of Middle Atlantic Archaeology 7:43-52.

Custer, J. F.
1984 Delaware Prehistoric Archaeology: An Ecological Approach. University of Delaware Press, Newark, Delaware.

1986a Core Technology at the Hawthorn Site, New Castle County, Delaware: A Late Archaic Hunting Camp. In The Organization of Core Technology, edited by J. K. Johnson and C. Marrow, pp. 45-62. Westview Press, Boulder, Colorado.

1986b Late Woodland Cultures of the Susquehanna Valley. In Late Woodland Cultures of the Middle Atlantic Region, edited by J. F. Custer, pp. 116-142. University of Delaware Press, Newark.

1989 Prehistoric Cultures of the Delmarva Peninsula: An Archaeological Study. University of Delaware, Newark.

1990 Early and Middle Archaic Cultures of Virginia: Culture Change and Continuity. In Early and Middle Archaic Research in Virginia: A Synthesis, edited by T. R. Reinhart and M. E. Hodges, pp. 1-60. Archaeological Society of Virginia, Richmond.

1991 Notes on Broadspear Function. Archaeology of Eastern North America 19:51-74.

Custer (cont.)
n.d.a Prehistoric Cultures of Eastern Pennsylvania. Pennsylvania Historical and Museum Commission Anthropological Series (In Press).

n.d.b Phase I/II Archaeological Investigations at Selected Locations of the Woodland Crossing Development, Sussex County, Delaware. Submitted to Delmarva Properties, West Point, Virginia.

Custer, J. F., and D. C. Bachman
1982 Phase III Data Recovery Excavations of the Prehistoric Components from the Hawthorn Site 7NC-E-46, New Churchman's Road, Christiana, New Castle County, Delaware. Delaware Department of Transportation Archaeology Series No. 27. Dover.

1985 Analysis of Projectile Point Morphology, Use Wear, and Activity Areas at the Hawthorn Site (7NC-E-46), New Castle County, Delaware. Journal of Middle Atlantic Archaeology 2:37-62.

1986 An Archaeological Planning Survey of Selected Portions of the Proposed Route 13 Corridor, New Castle County, Delaware. Delaware Department of Transportation Archaeology Series No. 44. Dover.

Custer, J. F., W. P. Catts, J. Hodny, and C. DeSantis Leithren
1990 Final Archaeological Investigations at the Lewden Green Site (7NC-E-9), Christiana, New Castle County, Delaware. Delaware Department of Transportation Archaeology Series No. 85. Dover.

Custer, J. F., and C. DeSantis
1986 A Management Plan for the Prehistoric Archaeological Resources of Northern Delaware, Bulletin of the Archaeological Society of Delaware 21.

Custer, J. F., A. Hoseth, D. K. Cheshaek, M. E. Guttman, and K. Iplenski
1993 Data Recovery Excavations at the Slackwater Site (36LA207), Manor Township, Lancaster County, Pennsylvania. Ms. on file, Pennsylvania Historical and Museum Commission, Harrisburg.

Custer, J. F., and B. Hsiao Silber
n.d. Final Archaeological Investigations at the Snapp Farm Site (7NC-G-101) New Castle County, Delaware. Department of Transportation Archaeological Series (in press). Dover.

Custer, J. F., J. Ilgenfritz, and K. R. Doms
1988 Application of Blood Residue Analysis Techniques in the Middle Atlantic Region. Journal of Middle Atlantic Archaeology 4:99-104.

Custer, J. F., and G. Mellin
1991 Preliminary Report on Archaeological Survey and Testing in the Atlantic Coast Zone of Delaware, 1987-1990. Bulletin of the Archaeological Society of Delaware 28:1-94.

Custer, J. F., K. R. Rosenberg, G. Mellin, and A. Washburn
1990 A Reexamination of the Island Field Site (7K-F-17), Kent County, Delaware. Archaeology of Eastern North America 18:145-212.

Custer, J. F., and R. M. Stewart
1990 Environment, Analogy, and Early Paleo-Indian Economies in Northeastern North America. In Early Paleo-Indian Economies of Eastern North America, edited by K. B. Tankersley and B. Isaac, pp. 303-322. JAI Press, Greenwich, Connecticut.

Custer, J. F., M. C. Stiner, and S. C. Watson
1983 Excavations at the Wilgus Site (7S-K-21). Bulletin of the Archaeological Society of Delaware 15:1-44.

Custer, J. F., and S. C. Watson
1985 Archaeological Investigations at 7NC-E-42, A Contact - Period Site in New Castle County, Delaware. Journal of Middle Atlantic Archaeology 1:97-116.

Cutler, H. C.
1965 Cultivated Plants. In The McGraw Site: A Study in Hopewellian Dynamics, Scientific Publications of the Cleveland Museum of Natural History 3, edited by O. Prufer, pp. 107-112.

Dimbleby, G. W.
1985 The Palynology of Archaeological Sites. Academic Press, New York.

Dincauze, D.F.
1976 The Neville Site: 8000 Years at Amoskeag. Peabody Museum Monograph 4. Cambridge, Massachusetts.

Donehoo, George P.
1928 A History of the Indian Villages and Place Names in Pennsylvania. Telegraph Press, Harrisburg.

Drennan, R. D.
1976 Religion and Social Evolution in Formative Mesoamerica. In The Early Mesoamerican Village, edited by K. Flannery, pp. 345-368. Academic Press, New York.

Dumont, E. M., and L. A. Dumont
1979 Of Paradigms and Projectile Point: Two Perspectives on the Early Archaic in New York. Bulletin of the New York State Archaeological Association 75:38-51.

Evans, J., and J. F. Custer
1990 Guidelines for Standardizing Projectile Point Typology in the Middle Atlantic Region. Journal of Middle Atlantic Archaeology 6:31-42.

Feidel, S.
1990 Middle Woodland Algonkian Expansion: A Refined Model. North American Archaeologist 11:209-230.

Fitzgibbons, P. T., and F. J. Vento
1987 Phase I Investigations for Prehistoric Archaeological Resources in the Lock Haven Flood Protection Project Study Area, Clinton County, Pennsylvania. Report prepared by Vendel Enviro-Industrial Consultants, Inc. for the United States Army Corps of Engineers, Baltimore District.

Flannery, K. V.
1973 The Origins of Agriculture. Annual Review of Anthropology 2:271-310.

1976 Emperical Determination of Site Catchments in Oaxaca and Tehuacan. In The Early Mesoamerican Village, edited by K. V. Flannery, pp. 103-117. Academic Press, New York.

Fogelman, G. L.
1991 Glass Trade Beads of the Northeast. Fogelman Publishing Company, Turbotville, Pennsylvania.

Foss, J. E.
1977 The Pedological Record at Several Paleo-Indian Sites in the Northeast. Annals of the New York Academy of Sciences 288:234-244.

Funk, R. E.
1976 Recent Contributions to Hudson Valley Prehistory. New York State Museum and Science and Science Service Memoir 22. Albany.

1978 Post-Pleistocene Adaptations. In Handbook of North American Indians, Vol. 15: Northeast, edited by Bruce Trigger, pp. 16-27. Smithsonian Institution, Washington, DC.

1988 The Laurentian Concept: A Review. Archaeology of Eastern North America 16:1-42.

1991 The Middle Archaic in New York. Journal of Middle Atlantic Archaeology 7:7-18.

Funk, R. E., and B. Wellman
1984 Evidence of Early Holocene Occupations in the Upper Susquehanna Valley, New York State. Archaeology of Eastern North America 12:81-109.

Gardner, W. M.
1969 The Havanna Cultural Tradition Occupation in the Upper Kaskaskia River Valley, Illinois. Ph.D. dissertation, University of Illinois, University Microfilms, Ann Arbor.

1989 An Examination of Cultural Change in the Late Pleistocene and Early Holocene (ca. 9200 to 6800 BC). In Paleo-Indian Research in Virginia, edited by J.M. Wittkofski and T.R. Rinehart, pp. 5-52. Archaeological Society of Virginia, Richmond.

Garrahan, F. D.
1990 Airport II Site: A Clemson Island/Owasco Settlement on the North Branch of the Susquehanna River. Pennsylvania Archaeologist 60(1):1-31.

Geier, C.
1990 The Early and Middle Archaic Periods: Material Culture and Technology. In Early and Middle Archaic Research: A Synthesis, edited by T. R. Reinhart and M. E. Hodges, pp. 81-98. Archaeological Society of Virginia, Richmond.

George, R. L., and C. F. Davis
1986 A Dated Brewerton Component in Armstrong County, Pennsylvania. Pennsylvania Archaeologist 56(1-2):12-20.

Goodwin, R. C., and Associates
1988 An Archaeological and Historical Overview of the Wyoming Valley Flood Protection Study Area, Susquehanna River Valley, Luzerne, Montour, and Northumberland Counties, Pennsylvania. Submitted to United States Army Corps of Engineers, Baltimore.

Goodyear, A. C.
1979 A Hypothesis for the Use of Crptocrystalline Raw Materials among Paleo-Indian Groups of North America. University of South Carolina Institute of Archaeology and Anthropology Research Manuscript Series No. 156.

Gramly, R. M., and J. Lothrop
1984 Archaeological Investigations of the Potts Site, Oswego County, New York, 1982 and 1983. Archaeology of Eastern North America 12:122-158.

Graybill, J.
1981 The Eastern Periphery of Fort Ancient (AD 1050 - 1650): A Diachronic Approach to Settlement Variability. Ph.D. dissertation, University of Washington, University Microfilms, Ann Arbor.

1989 The Shenks Ferry Complex Revisited. In New Approaches to Other Pasts, edited by W. F. Kinsey and R. W. Moeller, pp. 51-60. Archaeological Services, Bethlehem, Connecticut.

Griffith, D. R., and J. F. Custer
1985 Late Woodland Ceramics of Delaware: Implications for the Late Prehistoric Archaeology of Northeastern North America. Pennsylvania Archaeologist 55(3):5-20.

Gruber, J. W.
1971 Patterning in Death in a Late Prehistoric Village in Pennsylvania. American Antiquity 36:64-76.

Guilday, J. E., P. W. Parmalee, and D. P. Tanner
1962 Aboriginal Butchering Techniques at the Eschleman Site (36LA12), Lancaster County, Pennsylvania. Pennsylvania Archaeologist 32(2):59-83.

Gunn, J., and R. Mahula
1977 Hop Hill: Culture and Climate Change in Central Texas. Center for Archaeological Research, University of Texas at San Antonio, Special Report No. 5.

Hall, R. L.
1980 Ceramics. In Investigations at the Labras Lake Site, edited by J. A. Phillips, R. L. Hall, and R. W. Yerkes. Reports of Investigations, No. 1. Department of Anthropology, University of Illinois - Chicago Circle.

Hally, D. J.
1983 Use Alteration of Pottery Vessel Surfaces: An Important Source of Evidence for the Identification of Vessel Function. North American Archaeologist 4:3-26.

Harrington, J. C.
1954 Dating Stem Fragments of Seventeenth and Eighteenth Century Clay Tobacco Pipes. Quarterly Bulletin of the Archaeological Society of Virginia 9(1).

Hart, J.
1993a Monongahela Subsistence - Settlement Change: The Late Prehistoric Period in the Lower Upper Ohio River Valley. Journal of World Prehistory 7(1):71-120.

1993b Archaeological Investigations at the Memorial Park Site (36CN164) Clinton County, Pennsylvania. Report submitted to United States Army Corps of Engineers, Baltimore.

Hassan, F. A.
1981 Demographic Archaeology. Academic Press, New York.

Hatch, J. W.
1980 The Fisher Farm Site: A Late Woodland Hamlet in Context. Pennsylvania State University Department of Anthropology Occasional Paper No. 12. University Park.

1983 A Stratigraphic Analysis of Late Woodland Culture Change at Fisher Farm. Pennsylvania Archaeologist 53(1-2):11-27.

Hatch, J. W., C. M. Stevenson, and D. Nichols
1979 An Archaeological Reconnaissance for the Proposed Scranton Area Transmission Line, Lackawanna, Pennsylvania. Final Report Submitted to Pennsylvania Power and Light Company.

Hatch, J. W., C. Hamilton, L. Ries, and C. Stevenson
1985 The Ridge and Valley Province. In A Comprehensive State Plan for the Conservation of Archaeological Resources, Volume II, prepared by P. A. Raiber, pp. 83-163. Pennsylvania Historical and Museum Commission, Harrisburg.

Hay, C. A.
1987 Lock Haven Phase I and II Prehistoric Cultural Resources Inventory. Report prepared by Archaeological and Historical Consultants, Inc. for the United States Army Corps of Engineers, Baltimore District.

Hay, C. A., and C. Hamilton
1984 The Bald Eagle Township Sewer Collection System Archaeological Project. The Department of Anthropology Technical Report No. 2. Pennsylvania State University.

Hay, C. A., and J. W. Hatch
1987 A Management Plan for Clemson Island Archaeological Resources in the Commonwealth of Pennsylvania. Pennsylvania Historical and Museum Commission Bureau of Historic Preservation, Harrisburg.

Hay, C. A., J. W. Hatch, and J. Sutton
1987 A Management Plan for Clemson Island Archaeological Resources in the Commonwealth of Pennsylvania. Pennsylvania Historical and Museum Commission, Bureau of Historic Preservation, Harrisburg.

Heisey, H.
1971 An Interpretation of Shenks Ferry Ceramics. Pennsylvania Archaeologist 41(4):44-70.

Heisey, H., and J. P. Witmer
1964 The Shenks Ferry People: A Site and Some Generalities. Pennsylvania Archaeologist 34(1):8-34.

Herbstritt, J. T.
1988 A Reference for Pennsylvania Radiocarbon Dates. Pennsylvania Archaeologist 58(2):1-29.

Higham, C.
1989 The Archaeology of Mainland Southeast Asia. Cambridge University Press, New York.

Hinton, R. J.
1981 Form and Patterning of Anterior Tooth Wear Among Aboriginal Human Groups. American Journal of Physical Anthropology 54:555-564.

Hume, I. N.
1969 A Guide to Artifacts of Colonial America. Alfred A. Knopf, Inc. New York.

Hunter, W. A.
1956 The Upper Susquehanna in the French and Indian War. Manuscript No. 1, William Penn Memorial Museum files.

Jennings, F.
1966 The Indian Trade of the Susquehanna Valley. Proceedings of the American Philosophical Society 110(6):406-424.

1968 Glory, Death, and Transfiguration: The Susquehannock Indians in the Seventeenth Century. Proceedings of the American Philosophical Society 112(1):15-53.

1971 The Constitutional Evolution of the Covenant Chain. Proceedings of the American Philosophical Society 115:28-96.

Johnson, J.
1986 Cohokia Core Technology in Mississippi: The View from the South. In The Organization of Core Technology, edited by J. Johnson and C. Marrow. Westview Press, Boulder, Colorado.

Johnson, M.
1989 The Lithic Technology and Material Culture of the First Virginians: An Eastern Clovis Perspective. In Paleoindian Research in Virginia: A Synthesis, edited by J. M. Wittkofski and T. R. Reinhart, pp. 95-138. Archaeological Society of Virginia, Richmond.

Johnson, W., and S. Speedy
1992 Cultural Continuity and Change in the Middle and Late Woodland Periods in the Upper James Estuary, Prince George County, Virginia. Journal of Middle Atlantic Archaeology 8:91-106.

Johnston, R.
1961 The Aborigines of Cawichnowane. Pennsylvania Archaeologist 31(3-4):125-130.

Jones, R. W.
1931 Report of Excavations at the Clemson and Book Mounds. Fifth Report of the Pennsylvania Historical and Museum Commission, pp. 97-111. Harrisburg.

Jones, W.
1890 Finger - Ring Lore: Historical, Legendary, Anecdotal. Chatto and Windus, Piccadilly.

Karklins, K.
1992 Trade Ornament Usage Among the Native Peoples of Canada: A Source Book. National Historic Sites, Parks Service, Ottawa.

Kauffman, B. E., and R. J. Dent
1982 Preliminary Floral and Faunal Recovery and Analysis at the Shawnee-Minisink Site (36MR43). In Practicing Environmental Archaeology: Methods and Interpretations, edited by R. W. Moeller, pp. 7-11. American Indian Archaeological Institute, Washington, Connecticut.

Kavanagh, M.
1982 Archaeological Resources of the Monocacy River Region. Maryland Geological Survey Division of Archaeology File Report 164. Baltimore.

Kelly, J. E., F. A. Finney, D. L. McElrath, and S. J. Ozuk
1984 The Late Woodland Period. In American Bottom Archaeology, edited by C. J. Bareis and J. W. Porter, pp. 104-127. University of Illinois Press, Urbana.

Kent, B. C.
1970 Diffusion Spheres and Band Territoriality among the Archaic Cultures of the Northern Piedmont. Ph.D. dissertation, Pennsylvania State University. University Microfilms, Ann Arbor.

1983a More on Gunflints. Historical Archaeology 17(2):25-40.

1983b The Susquehanna Bead Sequence. In Proceedings of the 1982 Glass Trade Bead Conference. Rochester Museum and Science Service, Research Records No. 16, Rochester, New York.

1984 Susquehanna's Indians. Pennsylvania Historic and Museum Commission, Anthropological Series No. 6, Harrisburg.

Kent, B. C., J. Rice, and K. Ota
1981 A Map of Eighteenth Century Indian Towns in Pennsylvania. Pennsylvania Archaeologist 51(4):1-18.

Kidd, K. E., and M. A. Kidd
1970 A Classification System for Glass Beads for the Use of Field Archaeologists. Canadian Historic Sites: Occasional Papers in Archaeology and History. No. 1: 45-89. National Historic Sites Service, National and Historic Park Branch, Department of Indian Affairs and Northern Development. Ottawa.

Kinsey, W. F.
1959a Recent Excavations on Bare Island in Pennsylvania: The Kent-Hally Site. Pennsylvania Archaeologist 29(3-4):109-133.

1959b Historic Susquehannock Pottery. In Susquehannock Miscellany, edited by J. Witthoft and W. F. Kinsey, pp. 61-98. Pennsylvania Historical and Museum Commission, Harrisburg.

Kinsey (cont.)
1972 Archaeology in the Upper Delaware Valley. Pennsylvania Historical and Museum Commission, Anthropological Series No. 2. Harrisburg.

1975 Faucett and Byram Sites: Chronology and Settlement in the Delaware Valley. Pennsylvania Archaeologist 45(1- 2):1-103.

Kinsey, W. F., and J. F. Custer
1982 Lancaster County Park Site (36LA96): Conestoga Phase. Pennsylvania Archaeologist 52(3-4):25-56.

Kinsey, W. F., and J. R. Graybill
1971 Murry Site and Its Role in Lancaster and Funk Phase of Shenks Ferry Culture. Pennsylvania Archaeologist 41(4):7-43.

Kolb, C. C., and J. B. Hunter
1968 Features and Postmold Patterns of the Workman Site (36BD36). In A Preliminary Report of Archaeological Investigations of the Workman Site (36BD36, Bedford County, Pennsylvania), edited by J. W. Michels, J. B. Hunter, and L. M. Willey, pp. 143-174. The Pennsylvania State University Department of Anthropology Occasional Paper No. 4.

Kraft, H. C.
1975 The Archaeology of the Tocks Island Area. Archaeological Research Center, Seton Hall University, South Orange, New Jersey.

1986 The Lenape: Archaeology, History, and Ethnography. New Jersey Historical Society, Newark.

Larson, C.
1983 Behavioral Implications of Temporal Change in Cariogenesis. Journal of Archaeological Science 10:1-8.

LeeDecker, C., and C. Holt
1991 Excavation of the Indian Creek V Site (18PR94), Prince Georges County, Maryland. Report submitted to the Washington Metropolitan Area Transit Authority, Washington, D.C.

Lothrop, J. C., and R. M. Gramly
1982 Pieces esquillees from the Vail site. Archaeology of Eastern North America 10:1-11.

Louis Berger and Associates
1983 Abbot Farm National Landmark: Phase II Cultural Resource Survey and Mitigation Plan. New Jersey Department of Transportation and Federal Highway Administration, Trenton, New Jersey.

Lowery, D.
1989 The Paw Paw Cove Paleo-Indian Site Complex, Talbot County, Maryland. Archaeology of Eastern North America 17:143-164.

Lowery, D., and J. F. Custer
1990 Crane Point: An Early Archaic Site In Maryland. Journal of Middle Atlantic Archaeology 6:75-120.

Lucy, C. L.
1991 The Owasco Culture: An Update. Journal of Middle Atlantic Archaeology 7:169-188.

MacNeish, R. S.
1952 The Archaeology of the Northeastern United States. In Archaeology of the Eastern United States, edited by J. B. Griffin, pp. 46-58. University of Chicago Press, Chicago.

1980 Iroquois Pottery Types 32 Years Later. In Proceedings of the 1979 Iroquois Pottery Conference, Research Records of the Rochester Museum and Science Center No. 13, edited by C. F. Hayes, pp. 1-8. Rochester.

1992 The Origins of Agriculture and Settled Life. University of Oklahoma Press, Norman.

Magne, M.
1985 Lithics and Livelihood: Stone Technologies of Central and Southern Interior British Columbia. Archaeological Survey of Canada Paper 133. Ottawa.

Mann, A., and S. P. Murphy
1990 Bone Disease: A Guide to Pathologic and Normal Variation in the Human Skeleton. C. C. Thomas, New York.

Maslowski, R.
1984 The Significance of Cordage Attributes in the Analysis of Woodland Pottery. Pennsylvania Archaeologist 54(1-2):51-60.

McWeeney, L.
1984 Wood Identification and Archaeology in the Northeast. North American Archaeologist 5(3):183-196.

Meginness, J. F.
1889 Otzinachson: A History of the West Branch Valley of the Susquehanna. Gazette and Bulletin Printing House, Williamsport, Pennsylvania.

Michels, J. W., and I. F. Smith, III
1967 Archaeological Investigations of Sheep Rockshelter, Huntingdon County, Pennsylvania. Volume 1-2. Pennsylvania State University.

Michlovic, M. G.
1976 Social Interaction and Point Types in the Eastern United States. Pennsylvania Archaeologist 46(1-2):13-16.

Moeller, R. W.
1975a Late Woodland Floral and Faunal Exploitative Patterns in the Upper Delaware Valley. In Proceedings of the 1975 Middle Atlantic Archaeological Conference, edited by W. F. Kinsey, pp. 51-56. North Museum, Franklin and Marshall College, Lancaster, Pennsylvania.

1975b Plants and Seasonality: Some Observations and Comparisons. In Archaeological Excavations: Upper Delaware Valley, 1974, North Museum Publication No. 2, edited by W. F. Kinsey, pp. 38-44. Franklin and Marshall College, Lancaster, Pennsylvania.

1980 6LF21: A Paleo-Indian Site in Western Connecticut. American Indian Archaeological Institute, Bethlehem, Connecticut.

1986 Theoretical and Practical Considerations in the Application of Flotation for Establishing, Evaluating, and Interpreting Meaningful Cultural Frameworks. Journal of Middle Atlantic Archaeology 2:1-22.

1993 Analyzing and Interpreting Late Woodland Features. Occasional Publications in Northeastern Anthropology No. 12. Archaeological Services, Bethlehem, Connecticut.

Mounier, R. A.
1987 Estimation of Capacity in Aboriginal Conoidal Vessels. Journal of Middle Atlantic Archaeology 3:95-102.

Nass, J. P., and J. R. Graybill
1991 Excavation of Portions of the Kauffman II Site Situated within the Proposed Texas Eastern Pipeline Right-of-Way, Chester County, Pennsylvania. Ms. on file Pennsylvania Historical and Museum Commission, Harrisburg.

Neumann, T. N.
1989 Phase II Intensive Survey, Historic and Prehistoric Archaeological Investigations at Lock Haven, Clinton County, Pennsylvania. Report prepared by R. Christopher Goodwin and Associates, Inc. for the United States Army Corps of Engineers, Baltimore District.

Niemczycki, M.
1984 The Origin and Development of the Seneca and Cayuga Tribes of New York State. Research Records of the Rochester Museum and Science Center No. 17. Rochester.

Odell, G., and F. Cowan
1986 Experiments with Spears and Arrows on Animal Targets. Journal of Field Archaeology 13(2):195-211.

Ozker, D.
1982 An Early Woodland Community at the Schultz Site (20SA2) in the Saginaw Valley and the Nature of the Early Woodland Adaptation in the Great Lakes Region. Anthropological Papers No. 70, University of Michigan Museum of Anthropology, Ann Arbor.

Parker, A. C.
1968 Iroquois Uses of Maize and Other Food Plants. In Parker on the Iroquois, edited by W. N. Fenton, pp. 1-119. Syracuse University Press, Syracuse, New York.

Parry, W. J.
1989 The Relationship Between Lithic Technology and Changing Mobility Strategies in the Middle Atlantic Region. In New Approaches to Other Pasts, edited by W. F. Kinsey and R. W. Moeller, pp.29-34. Archaeological Service, Bethlehem, Connecticut.

Parry, W. J., and A. L. Christenson
1987 Prehistoric Stone Technology on Northern Black Mesa, Arizona. Southern Illinois University at Carbondale, Center for Archaeological Investigations Occasional Paper 12. Carbondale.

Parry, W. J., and R. Kelly
1986 Expedient Core Technology and Sedentism. In The Organization of Core Technology, edited by J. K. Johnson and C. Marrow, pp. 285-304. Westview Press, Boulder, Colorado.

Parsons, R.
1974 Statistical Analysis: A Decision-Making Approach. Harper and Row, New York.

Pennsylvania Archaeological Site Survey Files, William Penn Memorial Museum.

Photographic Files. William Penn Memorial Museum.

Piperno, D.
1988 Phytolith Analysis: An Archaeological and Geological Perspective. Academic Press, New York.

Potter, S.
1993 Commoners, Tribute, and Chiefs: The Development of Algonquian Culture in the Potomac Valley. University of Virginia Press, Charlottesville.

Price, T. D.
1989 The Chemistry of Prehistoric Human Bone. Cambridge University Press, New York.

Raiber, P. A. (editor)
1985 A Comprehensive State Plan for the Conservation of Archaeological Resources, Vol. I. Pennsylvania Historical and Museum Commission, Harrisburg.

Rasson, J. A., and S. T. Evans
1980 Cultural Resource Reconnaissance, Wyoming Valley Local Flood Protection, Luzerne County, Pennsylvania. Submitted to United States Army Corps of Engineers, Baltimore.

Rice, P. M.
1987 Pottery Analysis: A Sourcebook. University of Chicago Press, Chicago, Illinois.

Riley, L., J. F. Custer, and A. Hoseth
n.d. Final Archaeological Investigations at the Paradise Lane Site (7NC-D-125), Ogletown Interchange Improvements Project Area, New Castle County, Delaware. Delaware Department of Transportation Archaeological Series No. (in press). Dover.

Riley, L., S. C. Watson, and J. F. Custer
1993 Final Archaeological Investigations at Prehistoric Sites 7K-C-360 and Dover Downs (7K-C-365A and B), State Route 1 Corridor, Kent County, Delaware. Delaware Department of Transportation Archaeology Series No. 105. Dover.

Ritchie, W. A.
1961 A Typology and Nomenclature for New York State Projectile Points. New York State Museum and Science Service Bulletin 384. Albany.

1969 The Archaeology of New York State. Second Edition. Natural History Press, Garden City, New York.

Ritchie, W. A., and R. E. Funk
1971 Evidence for Early Archaic Occupations on Staten Island. Pennsylvania Archaeologist 41(3):45-59.

1973 Aboriginal Settlement Patterns in the Northeast. New York State Museum and Science Service Memoir 20. Albany.

Ritchie, W. A., and R. S. MacNeish
1949 The Pre-Iroquoian Pottery of New York State. American Antiquity 15:97-124.

Scarisbrick, D.
1993 Rings: Symbols of Wealth, Power, and Affection. Harry N. Abrems, Inc. New York.

Schiffer, M. B.
1990 The Influence of Surface Treatment on Heating Effectiveness of Ceramic Vessels. Journal of Archaeological Science 17:373-381.

Schoff, H. L.
1937 Report on Archaeological Investigations Carried on at the J. T. Roberts Property, Mountoursville, Lycoming County, Pennsylvania. Pennsylvania Archaeologist 7(1):8.

Scull, W.
1770 A Map of Pennsylvania. Reproduced in Pennsylvania Archives, 3rd. Series, Appendix I - X, No. 19.

Shelford, V. E.
1963 The Ecology of North America. University of Illinois Press, Urbana.

Skibo, J. M.
1992 Pottery Function: A Use-Alteration Perspective. Plenum Press, New York.

Smith, B.
1985 Mississippian Settlement Patterns. Academic Press, New York.

1992 Rivers of Change: Essays on Early Agriculture in Eastern North America. Smithsonian Institution Press, Washington, D.C.

Smith, I. F. III
1972 Multiple Field Digs Produce Many Important Finds. Pennsylvania Heritage 6:1, 4-6.

1973 The Parker Site: A Manifestation of the Wyoming Valley Culture. Pennsylvania Archaeologist 43(3-4):1-56.

1976 A Functional Interpretation of Keyhole Structures in the Northeast. Pennsylvania Archaeologist 46(1-2):1-12.

1984 A Late Woodland Village Site in Northcentral Pennsylvania: Its Role in Susquehannock Culture History. Pennsylvania Historical and Museum Commission, Harrisburg.

Smith I., and J. Graybill
1977 A Report on the Shenks Ferry and Susquehannock Components at the Funk Site, Lancaster County, Pennsylvania. Man in the Northeast 13:45-64.

Snow, D. R.
1980 The Archaeology of New England. Academic Press, New York.

Stewart, R. M.
1980a Environmental Settlement Pattern and the Prehistoric Use of Rhyolite in the Great Valley of Maryland and Pennsylvania. Paper presented at the 1980 Middle Atlantic Archaeological Conference, Dover.

1980b Prehistoric Settlement/Subsistence Patterns and the Testing of Predictive Site Location Models in the Great Valley of Maryland. Ph.D. dissertation, Catholic University of America. University Microfilms, Ann Arbor.

1983 Soils and Archaeology of the Abbott Farm. North American Archaeologist 4:27-50.

1984 South Mountain (Meta) Rhyolite: A Perspective of Prehistoric Trade and Exchange in the Middle Atlantic Region. In Prehistoric Lithic Exchange Systems in the Middle Atlantic Region, edited by J. F. Custer, pp. 14-44. University of Delaware Center for Archaeological Research, Monograph No. 3. Newark, Delaware.

1987 Rhyolite Quarry and Quarry-Related Sites in Maryland and Pennsylvania. Archaeology of Eastern North America 15:47-58.

1988 Clemson's Island Cultures in the West Branch Valley: Phase I and II Archaeological Investigations 36UN11. Pennsylvania Department of Transportation and Louis Berger and Associates, Harrisburg.

1989 Trade and Exchange in Middle Atlantic Prehistory. Archaeology of Eastern North America 17:47-78.

1990 Clemson's Island Studies in Pennsylvania: A Perspective. Pennsylvania Archaeologist 60(1):79-107.

1991a A Middle Archaic Period Sampler: Introduction. Journal of Middle Atlantic Archaeology 7:1-5.

1991b Archaeology and Environment in the Upper Delaware Valley. In The People of Minisink, edited by D. G. Orr and D. Campana, pp. 79-116. National Park Service, Mid-Atlantic Region, Philadelphia.

Stewart, R. M., and J. A. Cavallo
1991 Delaware Valley Middle Archaic. Journal of Middle Atlantic Archaeology 7:19-42.

Stewart, T. B.
1939 Large Population of Red Men Roamed West Branch Valley Lock Haven Express, Centennial Edition. December 2, 1939.

Stone, L. M.
1974 Fort Michilmackinac 1715-1781. Anthropological Series, Vol. 2. Publications of the Museum, Michigan State University, East Lansing, Michigan.

Stuiver, M. and P. J. Reimer
1986 A Computer Program for Radiocarbon Age Calibration. Radiocarbon 28(2B):1022-1030.

Taylor, R. E.
1987 Radiocarbon Dating: An Archaeological Perspective. Academic Press, New York.

Thomas, R. A.
1970 Adena Influence in the Middle Atlantic Coast. In Adena: The Seeking of an Identity, edited by B. K. Swartz, pp. 56-87. Ball State University, Muncie, Indiana.

Thomas, R. A., and N. Warren
1970 A Middle Woodland Cemetery in Central Delaware: Excavations at the Island Field Site. Bulletin of the Archaeological Society of Delaware 8.

Tompkins, R. C., and L. DiMaria
1979 Excavations at Muddy Brook Rockshelter; 1975-1976: A Progress Report. Bulletin of the New York State Archaeological Association 75:58-64.

Trigger, B.
1981 Prehistoric Social and Political Organization: An Iroquoian Case Study. In Foundations of Northeast Archaeology, edited by D. Snow, pp. 1-50. Academic Press, New York.

Turnbaugh, W. A.
1977 Man, Land, and Time. Unigraphic Press, Evansville, Indiana.

Turnbaugh, W. A., and D. R. Schmidt
1979 Interpreting Finds from a Small Disturbed Site. Pennsylvania Archaeologist 49(4):1-8.

Turner, E. R.
1978 Population Distribution in the Virginia Coastal Plain, 8000 B.C. to A.D. 1600. Archaeology of Eastern North America 8:60-72.

United States Army Corps of Engineers, Baltimore District.
1975 Lock Haven General Design Memorandum, United States Army Corps of Engineers, Baltimore District.

United States Army Corps of Engineers, Baltimore District.
1987 Lock Haven Local Flood Protection Project, West Branch Susquehanna River and Bald Eagle Creek, Pennsylvania, Appendix F: Geotechnical Design Analyses. United States Army Corps of Engineers, Baltimore District.

Vennum, T.
1988 Wild Rice and the Ojibway People. Minnesota Historical Society Press, St. Paul.

Vento, F. J., and P. T. Fitzgibbons
1989 Phase I Inventory Investigations of Potentially Significant Prehistoric and Historic Period Cultural Resources for the Lock Haven Flood Protection Project, Clinton County, Pennsylvania. Report Prepared by Vendel Enviro-Industrial Consultants, Inc. for the United States Army Corps of Engineers, Baltimore District.

Vento, F. J., and H. B. Rollins
1989 Development of a Late Pleistocene-Holocene Genetic Stratigraphic Framework as it Relates to Atmospheric Circulation and Climate in the Upper and Central Susquehanna River Drainage Basin. Ms. on file, Pennsylvania Historical and Museum Commission, Harrisburg.

Verrey, R. A.
1986 Paleo-Indian Stone Tool Manufacture at the Thunderbird Site (44WR11). Ph.D. dissertation, Catholic University of America, Washington, DC.

Wagner, D. R. (editor)
1979 Historic Lock Haven: An Architectural Survey. Clinton County Historical Society, Lock Haven, Pennsylvania.

Wallace, P. A. W.
1945 Conrad Weiser: Friend of colonist and Mohawk. University of Pennsylvania Press, Philadelphia.

1965 Indian Paths of Pennsylvania. Pennsylvania Historical and Museum Commission, Harrisburg.

Ward, H. H. and J. F. Custer
1988 Steatite Quarries of Northeastern Maryland and Southeastern Pennsylvania: An Analysis of Quarry Technology. Pennsylvania Archaeologist 58(2):33-49.

Watson, S. C., D. N. Bailey, and J. F. Custer
1992 Phase I and II Investigations for Cultural Resources Along West Water Street, Lock Haven, Clinton County, Pennsylvania. Manuscript on file, University of Delaware Center for Archaeological Research, Newark, Delaware.

Watson, S. C. and J. F. Custer
1990 Phase III Data Recovery Excavations at the Caryatid Site (28BU276) and the Eckert Farm Site (28BU115), Burlington County, New Jersey. Report submitted to the New Jersey Department of Transportation, Trenton.

Webster, G.
1984 Susquehannock Animal Economy. North American Archaeologist 6(1): 41-62.

Wellman, B., and K. S. Hartgen
1975 Prehistoric Site Survey and Salvage in the Upper Schoharie Valley, New York State. Eastern States Archaeological Federation Bulletin 34:15.

Weslager, C. A.
1972 The Delaware Indians: A History. Rutgers University Press, New Brunswick.

Willey, G. R.
1953 Prehistoric Settlement Patterns in the Viru Valley, Peru. Bureau of American Ethnology Bulletin No. 155. Washington, D.C.

Wilmsen, E. N.
1970 Lithic Analysis and Cultural Inference: A paleo-Indian Case. Anthropological Papers, University of Arizona No. 16. Tucson.

Winter, M. C.
1976 The Archaeological Household Cluster in the Valley of Oaxaca. In The Early Mesoamerican Village, edited by K. V. Flannery, pp. 25-31. Academic Press, New York.

Witthoft, J,
1952 A Paleo-Indian Site in Eastern Pennsylvania. Pennsylvania Archaeologist 96:464-495.

1954 Pottery from the Stewart Site, Clinton County, Pennsylvania. Pennsylvania Archaeologist 24(1):22-27.

1966 A History of Gunflints. Pennsylvania Archaeologist 36(1-2):12-49.

Yarnell, R. A.
1976 Early Plant Husbandry in Eastern North America. In Culture Change and Continuity: Essays in Honor of James Bennett Griffin, edited by C. E. Cleland, pp. 265-273. Academic Press, New York.

Yellen, J.
1977 Archaeological Approaches to the Present: Models for Reconstructing the Present. Academic Press, New York.

Zeisberger, D.
1910 History of the American Indians, edited by A. B. Hulbert and W. N. Schwauze. Ohio State Archaeological and Historical Quarterly 19:1-189.

Zeisberger, D., and J. M. Mack
1892 An Account of the Famine Among Indians of the North and West Branch of the Susquehanna River in the Summer of 1748. Pennsylvania Magazine of History and Biography 16(4):424-426.

APPENDICES

APPENDIX I

Clemson Island Features and Diagnostic Atifacts

Appendix I

Feature Number	Section	Context	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts In Feature/Comments
5	3	disturbed	Yes	No	Poplar Island point
6	3	disturbed	No	Yes?	Shell tempered ceramic, crushed rock ceramic, intersects Feature 6a
6A	3	disturbed	No	Yes?	Shell tempered ceramic, intersects Feature 6
8A	3	intact	No	No	
9	3	intact	No	No	Ceramic, ? type
10	3	disturbed	No	Yes?	Shell and grit tempered ceramic, ? type
11	3	disturbed	No	No	Clemson Island ceramic, olive glass
12	3	intact	No	No	Post- triangle point, corn
12A	3	disturbed	No	No	Post- Clemson Island ceramic, corn, Shenks Ferry ceramic, Shell tempered ceramic, glass beads
12C	3	intact	?	?	Post- corn
12D	3	intact	No	No	Post
13	3	disturbed?	No	No	Post- ceramic, ? type, corn seed bead from flotation
15	3	disturbed	Yes	No	Fishtail point, ceramic, ? type
16	3	intact	No	No	Post- corn
17	3	intact	No	No	Clemson Island ceramic
18	3	disturbed	No	No	Intersects Feature 530
20	3	intact	?	?	Post- corn
21	3	intact	No	No	Post- corn
22	3	intact	No	No	Post- ceramic, ? type, corn
23	3	intact	No	No	Post
24	3	intact	No	No	Ceramic, ? type
25	3	disturbed	No	No	Early Woodland point, intersects historic district
26	3	intact	No	No	Post- Clemson Island ceramic
27	3	intact	?	?	Post- corn
28	3	intact	No	No	Ceramic, unidentifiable
29	3	intact	?	?	Post
30	3	intact	?	?	Post
31	3	disturbed	Yes	No	Broadspear
32	3	disturbed	No	Yes	Clemson Island and Shenks Ferry ceramic, shell tempered ceramic?, type
33	3	intact	?	?	Post- corn
34	3	intact	No	No	Ceramic, unidentifiable
35	3	intact	No	No	Clemson Island ceramic, pipe fragments
36	3	disturbed	No	Yes	Clemson Island ceramic, gunflint
37	3	disturbed	No	No	Intersects feature not excavated separately
37A	3	disturbed	?	?	Post
38	3	intact	No	No	
39	3	intact	No	No	Possible hearth
40	3	intact	No	No	Ceramic, unidentifiable
41	3	intact	?	?	Post-corn
42	3	intact	No	No	Post- corn, seed bead from flotation
43	3	intact	No	No	Post- corn
44	3	intact	No	No	Ceramic, unidentifiable
45	3	intact	No	No	Post- corn
46	3	intact	No	No	Post
47	3	intact	No	No	Post
49	3	disturbed	No	No	Intersects Feature 49A
49A	3	disturbed	No	No	Intersects Feature 49
49B	3	intact	?	?	
53	3	intact	No	No	
54	3	intact	No	No	No-cultural material
55B	3	disturbed	No	No	Intersects Feature 55C
55C	3	disturbed	No	No	Intersects Feature 55B
56	3	intact	No	No	Corn (not a post)
58	3	intact	?	?	Post
60	3	intact	No	No	Clemson Island ceramic
61	3	intact	?	?	Post
63	3	intact	No	No	
64	3	intact	No	No	Ceramic, unidentifiable
65	3	intact	No	No	Posts A-E; A has ceramic, ? type
66	3	disturbed	No	No	Clemson Island ceramic, pewter or lead fragment
67	3	intact	No	No	Post
68	3	disturbed	Yes	Yes	Clemson Island ceramic, Brewerton point, stemmed point, Shell tempered ceramic ? type
68A	3	intact	No	No	
69	3	intact	No	No	Post
70	3	intact	No	No	
72	3	intact	No	No	
73	3	disturbed	No	No	Intersects Feature 73A
73A	3	disturbed	No	No	Intersects Feature 73
74	3	intact	No	No	
75	3	disturbed	Yes	Yes	Gunflint, corner-notched point, Clemson Island ceramic, cow bone
77	3	disturbed	Yes?	No	Ceramic, ? type, side-notched point
79	3	intact	No	Yes?	Ceramic, unidentifiable, clay tempered
80	3	intact	No	No	
81 n	3	disturbed	No	Yes	Intersects Feature 81A, cow bone
81 s	3	intact	?	?	?
83	3	intact	No	No	
84	3	intact	No	No	
85	3	intact	No	No	Ceramic, ? type
86	3	intact	No	No	Ceramic, unidentifiable

Appendix I

Feature Number	Section	Context	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts In Feature/Comments
87	3	intact	No	No	
89	3	intact	No	No	
89A	3	intact	No	No	Post
91	3	disturbed	Yes	No	Poplar Island point
92	3	intact	No	No	
93	3	intact	No	No	
93A	3	intact	No	No	
94	3	intact	No	No	
95	3	intact	No	No?	Catlinite pipe fragment
96	3	intact	No	No	Large post/small pit
97	3	intact	No	No	
98	3	intact?	No?	No?	Has steatite fragments
99	3	intact	No	No	
101	3	intact	No	No	Clemson Island ceramic, triangle point
103	3	intact	?	?	Large post/small pit, corn
104	3	intact	No	No	Large post/small pit, Clemson Island ceramic, seed bead from flotation
105	3	disturbed	Yes?	No	Side-notched point
106	3	intact	No	No	Large post/small pit, corn
111	3	intact	No	No	
112	3	intact	?	?	Post
113	3	intact	No	No	Clemson Island ceramic
115	3	intact	No	No	
116	3	disturbed	Yes	No	Stemmed point
117	3	disturbed	No	No	Intersects Feature 118
118	3	disturbed	No	No	Intersects Features 117, 118A, 118B
118A	3	disturbed	No	No	Intersects Feature 118, steatite
118B	3	disturbed	No	No	Post, intersects Feature 118
120	3	disturbed	No	Yes	Clemson Island ceramic, Shenks Ferry ceramics
121	3	disturbed?	No	Yes?	Clay tempered ceramic, unidentifiable
122	3	disturbed	Yes	No	Stemmed point, intersects Feature 122A
122A	3	disturbed	No	No	Intersects Feature 122
123	3	intact	No	No	
124	3	intact	No	No	Large post/small pit- Clemson Island ceramic
125	3	intact	?	?	Large post/small pit
126	3	intact	No	No	Ceramic, ? type
127	3	intact	?	?	Large post/small pit, corn
128	3	intact	?	?	Post- corn
129	3	disturbed?	?	Yes	Post- corn, seed bead from flotation
131	3	intact	?	?	Large post/small pit- corn
132	3	disturbed	No	Yes	Corner-notched point
133	3	intact	No	No	
134	3	intact	No	No	Ceramic, ? type
135	3	intact	No	No	
136	3	intact	?	?	
137	3	intact	No	No	
138	3	intact	No	No	Ceramic, ? type
139	3	disturbed	No	Yes?	Shell tempered ceramic, unidentifiable
140	3	intact	?	?	
141	3	intact	No	No	Ceramic, unidentifiable
143	3	intact	No	No	Post
144	3	intact	No	No	Clemson Island ceramic
145	3	intact	?	?	Post
146	3	intact	No	No	
147	3	disturbed	Yes	Yes	Olive glass, Clemson Island ceramic, broadspear
148	3	intact	No	No	Large post/small pit- No Cultural Material
149	3	intact	No	No	Clemson Island ceramic
153	3	intact	?	?	Post
157	3	intact	No	No	No Cultural Material
158	3	intact?	?	?	Ceramic, ? type
159	1	disturbed	Yes?	No	Triangle point, possible Susquehanna broadspear base ceramic, ? type
160	1	disturbed	No	No	Clemson Island ceramic, intersects Feature 160A, broadspear
160A	1	disturbed	No	No	Clemson ceramic, intersects Feature 160
161	1	intact	No	No	Post
162	1	intact	?	?	Large post/small pit, corn
163	1	intact	No	No	Post- No Cultural Material
165	1	disturbed	Yes	No	Broadspear
166A	1	disturbed	No	No	Intersects Features 166B, 166C, natural disturbance
166B	1	disturbed	Yes	No	Broadspear, intersects Features 166A, 166C
166C	1	disturbed	No	No	Intersects Features 166A, 166B
166D	1	intact	No	No	Post
167	1	intact	No	No	Post
168	1	disturbed	Yes	No	Clemson Island ceramic, broadspear, intersects Feature 168a
168A	1	disturbed	No	No	Intersects Feature 168, Clemson Island ceramic
169	1	intact	No	No	Post
170	1	disturbed	Yes	No	Broadspear, Clemson Island ceramic
171	1	disturbed	?	No	Steatite fragment, Clemson Island ceramic, intersects Features 171A, 171B, broadspear
171A	1	disturbed	No	No	Intersects Feature 171
171B	1	disturbed	No	No	Intersects Feature 171
172	1	disturbed	Yes	No	Broadspear, ceramic unidentifiable
173 A-F	1	intact	No	No	Posts A-F, Clemson Island ceramic in some
174	1	disturbed	Yes	No	Broadspear

Appendix I

Feature Number	Section	Context	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts in Feature/Comments
175	1	intact	No	No	Post
176	1	distributed	Yes	Yes	Teardrop point, side-notched point, Clemson Island ceramic, possible Shenks Ferry ceramic
177	1	intact	No	No	Post- Clemson Island ceramic
178	1	intact	No	No	Post
178A	1	intact	No	No	Post- No Cultural Material
179	1	distributed	No	No	Intersects natural disturbance
180	1	distributed	No	No	Ceramic, unidentifiable, intersects Feature 180 Area A
181	1	intact	No	No	
183	1	intact	No	No	
184	1	intact	No	No	
185	1	intact	No	No	No Cultural material
186	1	distributed	No	No	Intersects Feature 186A
186A	1	distributed	No	No	Intersects Feature 186
187	1	intact	No	No	Clemson Island ceramic
188	1	distributed	Yes	No	Broadspears, fishtail point, steatite
189	1	distributed	Yes	Yes?	Broadspear, incised ceramic, ? type, Clemson Island ceramic
190	1	distributed	?	No	Post- expanding stem point, ceramic, ? type
191	1	distributed	Yes	No	Stemmed point
192	1	intact	No	No	Post
193	1	intact	No	No	Clemson Island ceramic
194A	1	distributed	Yes	No	North 1/2- Clemson Island ceramic, intersects Features 194B, 195; south 1/2- broadspear
194B	1	distributed	No	No	Clemson Island ceramic, intersects Features 194A, 194C
194C	1	distributed	No	No	Northeast and northwest 1/4's- intersects Feature 194B
194C	1	intact	No	No	Southeast and southwest 1/4's- Clemson Island ceramic
194D	1	distributed	No	Yes?	Intersects Feature 194B, possible Shenks Ferry ceramic
195	1	distributed	Yes	No	Broadspear, Clemson Island ceramic, cow bone
196	1	intact	No	No	Clemson Island ceramic, triangle point
197	1	intact	No	No	Post- No Cultural Material
198	1	intact	No	No	Clemson Island ceramic
198A	1	intact	?	?	Post
200	1	intact	No	No	Ceramic, ? type
201	1	distributed	No	No	Intersects Feature 201G
201G	1	distributed	No	No	Intersects Feature 201
202	1	distributed	No	No	Intersects natural disturbance, ceramic, ? type
203	1	intact	No	No	Ceramic, ? type
204	1	intact	No	No	Post- No Cultural Material
205	1	intact	No	No	Clemson Island ceramic
205A	1	intact	?	?	Post
205B	1	intact	?	?	Post
205C	1	intact	?	?	Post
205D	1	intact	?	?	Post
207	1	intact	No	No	
208 north	1	intact	No	No	Ceramic, ? type
208 south	1	distributed	No	No	Intersects natural disturbance
209	1	intact	No	No	
211	1	intact	No	No	
212	1	intact	No	No	Hearth
213	1	intact	No	No	
215	1	distributed	No	No	Intersects natural disturbance
216	1	intact	No	No	
217	1	distributed	No	No	Intersects natural disturbance
219	1	intact	?	?	Large post/small pit
220	1	intact	No	No	
221	1	intact	No	No	
222	1	intact	?	?	Post
223	1	distributed	No	No	Intersects Features 223A, 223B
223A	1	distributed	No	No	Intersects Features 223, 223B
223B	1	distributed	No	No	Intersects Features 223, 223A
223C	1	intact	No	No	Post- No Cultural Material
224 north	1	intact	No	No	Ceramic, ? type
224 south	1	distributed	No	No	Intersects natural disturbance
226	1	distributed	No	No	Intersects Feature 227, steatite, ceramic, ? type
227	1	distributed	No	No	Intersects Feature 226
228	1	intact	No	No	Post- No Cultural Material
232	1	intact	No	No	Ceramic, ? type
233	1	intact	No	No	
235	1	distributed	Yes	Yes	Broadspear, glass bead, lead shot, pig teeth
235B	1	intact?	No	No?	Ceramic, ? type, steatite
236	1	intact	No	No	Clemson Island ceramic
237	1	intact	No	No	Ceramic, ? type
238	1	intact	No	No	
239	1	intact	No	No	
241	1	distributed	No	No	Intersects natural disturbance
242	1	distributed	No	No	Intersects natural disturbance
243	1	intact	No	No	Clemson Island ceramic
245	1	intact	?	?	Post
248 north	1	intact	No	No	Ceramic, ? type
248 south	1	distributed	No	No	Intersects natural disturbance
249	1	intact	No	No	
250	1	intact	No	No	

Appendix I

Feature Number	Section	Context	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts in Feature/Comments
254	3	intact	?	?	Post
269	3	intact	?	?	Post
277	3	intact	?	?	Post
279	3	intact	?	?	Post
284	3	intact	No	No	Post- No Cultural Material
285	3	intact	No	No	Post- corn
314	3	intact	No	No	Post- grit and clay tempered pipe bowl
360	3	intact	?	?	
395	3	intact	No	No	Clemson Island ceramic
403	3	intact	No	No	Ceramic, unidentifiable
404	3	disturbed	Yes	Yes?	Fishtail point, corner-notched point
471	3	intact	?	?	Post
476	3	intact	?	?	Post
498	3	disturbed	No	Yes?	Ceramic, shell tempered, ? type
499	3	intact	No	No	
500	3	intact	?	?	Post
503	3	intact	No	No	Clemson Island ceramic
504	3	intact	No	No	
517	3	intact	?	?	Post
518	3	intact	?	?	Post
519	3	intact	No	No	Large post/small pit
522	3	disturbed	No	No	Ceramic, ? type
522A	3	intact	?	?	Post
523	3	disturbed	No	No	Historic fill, rock and quartz tempered ceramic, ? type
524 north	3	intact	No	No	Ceramic, ? type
524 south	3	disturbed	No	No	Intersects Feature 524A
524A	3	disturbed	?	?	Post- intersects Feature 524 south, corn
525	3	intact	No	No	Post- No Cultural Material
526	3	disturbed	No	Yes	Ceramic, ? type, gunflint, nails
528	3	intact	No	No	Ceramic, ? type
529	3	intact	No	No	
530	3	disturbed	No	No	Intersects Feature 18
534	3	intact	?	?	Post- corn
535	3	disturbed	No	No	Two features, excavated as one
540	3	intact	No	No	No Cultural Material
542	3	intact	No	No	Clemson Island ceramic, triangle point
548	3	intact	?	?	Large post/ small pit
549	3	intact	?	?	
550	3	intact	No	No	Ceramic, ? type
551	3	intact	No	No	
552	3	intact	No	No	
555	1	intact	No	No	No Cultural Material
556	1	intact	No	No	Clemson Island ceramic
556A	1	intact	No	No	Post- ceramic, ? type
557	1	intact	No	No	Clemson Island ceramic
557	1	intact	?	?	Posts- A-D, F, G, N, T, W, X, Y, Z
559	1	intact	No	No	Burial- Clemson Island ceramic, triangle point
563	1	intact	No	No	Clemson Island ceramic, platform pipe fragment
564	1	intact	No	No	Clemson Island ceramic
565	1	intact	?	?	Post- possible historic
566	1	intact	?	?	Post
567	1	disturbed	?	?	Post- ball clay pipe stem
568	1	intact	No	No	No Cultural Material
569	1	intact	?	?	
570	1	intact	No	No	Post- No Cultural Material
572	1	disturbed	No	Yes	.38 caliber shell case
573	1	intact	No	No	Post- No Cultural material, may be historic
575	1	disturbed	No	Yes	Olive glass, Shenks Ferry ceramic
576	1	intact	No	No	Post
577	1	intact	No	No	Post- corn?
578	1	intact	No	No	
579	1	intact	No	No	Clemson Island ceramic
581	1	intact	No	No	Ceramic, ? type
584	1	intact	No	No	
585	1	disturbed	No	Yes?	Post- shell tempered ceramic, ? type
586	1	intact	No	No	Ceramic, ? type
593	1	disturbed	No	No	Intersects natural disturbance
594	1	intact	No	No	
597	1	intact	No	No	No Cultural Material
598	1	intact	No	No	Post- No Cultural Material
599	1	intact	No	No	Post- No Cultural Material
605	1	intact	No	No	Clemson Island ceramic
606	1	intact	No	No	Pipe fragments
607 south	1	intact	No	No	Clemson Island ceramic
607 north	1	disturbed	No	No	Clemson Island ceramic intersects Features 607A, 607B
607A	1	disturbed	No	No	Post- intersects Features 607 north, 607B
607B	1	disturbed	No	No	Post- intersects Features 607 north, 607A
608	1	intact	No	No	
646	3	intact	?	?	Post
683	3	intact	?	?	Post
687	3	intact	No	No	Hearth
688	3	intact	No	No	Ceramic, ? type

Appendix I

Feature Number	Section	Context	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts in Feature/Comments
689	3	intact	No	No	Ceramic, ? type
690	1	disturbed	No	No	Intersects Feature 690?- (probably a seperate feature)
690A	1	disturbed	No	No	Intersects Feature 690
691	1	intact	No	No	Post- No Cultural Material
692	1	intact	No	No	Post- No Cultural Material
693	1	disturbed	No	Yes?	Shenks Ferry ceramic?
694	1	intact	No	No	Ceramic, ? type
695	1	disturbed	No	No	Intersects Feature 695A
695A	1	disturbed	No	No	Intersects Feature 695
696	1	intact	No	No	
697	1	disturbed	Yes	No	Broadspear, ceramic, ? type
698	1	intact	No	No	
699	1	disturbed	No	No	Intersects Features 699A, 732
699A	1	disturbed	No	No	Post- intersects Feature 699, corn
702	1	intact	No	No	
703	1	intact	No	No	Post- ceramic, ? type
705	1	disturbed	No	No	Intersects natural disturbance
706	1	disturbed	No	Yes?	Ceramic, collared, rock and quartz tempered
707	1	intact	?	?	Post- corn
708	1	intact	No	No	Ceramic, ? type
709	1	intact	No	No	Pipe fragments
710	1	intact	No	No	Ceramic, ? type
714	1	intact	No	No	
715	1	intact	No	No	
717	1	intact	No	No	Ceramic, ? type
719	1	intact	No	No	Post- ceramic, ? type
720	1	intact	No	No	Post- ceramic, ? type
721	1	intact	No	No	Post- ceramic, ? type
724	1	intact	No	No	No Cultural Material
728	1	intact	No	No	No Cultural Material
730	1	disturbed	Yes?	No	Steatite fragment
732	1	disturbed	No	No	Intersects Feature 699

Feature numbers not listed are Non-Cultural Features

APPENDIX II

Contact, Clemson Island and Late Archaic Test Units and Diagnostic Atifacts

APPENDIX II
Diagnostic Artifacts from Contact, Clemson Island, and Late Archaic/Middle Woodland Test Units

Unit	Level	Contact	Clemson Island Artifacts Present?	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts
N78 W49	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N78 W50	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N78 W51	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	Yes	No	Ceramic type? 2 (Broadspears)
N78 W52	1	Yes?	Yes?	No	No	Ceramic type? 2 Native pipe fragments
	2	No	Yes?	No	No	Ceramic type?
N78 W53	surface	—	—	—	Woodland I	Ceramic type? Woodland I Point (Fox Creek)
	1 and 2	No	Yes?	No	No	Ceramic type?
N78 W54	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W48	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W49	1	No	Yes?	No	No	Ceramic type?
	2	Yes	Yes?	No	No	Contact bead (WIIc11), Ceramic type?
N79 W50	1	No	Yes?	No	Late Woodland	Shenks Ferry, Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W51	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W53	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W54	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W55	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W56	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W59	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N79 W60	1	No	Yes?	No	No	Ceramic type?
	2	Yes	Yes?	No	No	Contact bead (WIIc3), Ceramic type?
	3	No	Yes?	No	No	Ceramic type?
N79 W61	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	Yes	No	1 Brewerton point
	3	No	Yes?	No	No	Ceramic type?
N79 W62	1	No	Yes?	No	No	Ceramic type?
	2	Yes	Yes?	No	No	Ceramic type?, Contact bead (WI 65)
	3	No	Yes?	No	No	Ceramic type?
N79 W69	1	No	Yes?	No	Late Woodland	Late Woodland Triangle point, Ceramic type?
	2	Yes	Yes?	No	Late Woodland	Effigy pipe, Shenks Ferry ceramic, Ceramic type?
N79 W70	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W49	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W50	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W51	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W52	1	No	Yes	No	No	Clemson Island ceramic
	2	No	Yes?	No	No	Ceramic type?
N80 W53	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W54	1	No	Yes?	No	Late Woodland	Ceramic type?, triangle point
	2	No	Yes?	No	No	Ceramic type?
N80 W55	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W56	1	No	Yes?	No	No	Ceramic type?
	2	Yes	Yes?	No	No	Ceramic type?, Contact bead (WIIc11)
N80 W59	fill	—	—	Yes	—	Broadspear
	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W60	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W61	fill	No	Yes	Yes	No	Lamoka base, Ceramic type?
	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W62	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N80 W83	1	No	Yes?	No	No	Ceramic type?
N80 W69	1	No	Yes?	No	No	Ceramic type?
N80 W70	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N81 W50	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes	No	No	Clemson Island ceramic
N81 W52	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N81 W53	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?

APPENDIX II

Unit	Level	Contact Artifacts Present?	Clemson Island Artifacts Present?	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts
N81 W59	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N81 W60	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N81 W61	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes	No	No	Clemson Island ceramic
N81 W68	1	No	Yes?	No	No	Ceramic type?
N81 W69	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	Yes	No	Brewerton Point, Ceramic type?
N81 W70	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W55	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W56	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W59	1	Yes	Yes?	No	No	Contact bead (lead, Native pipe fragment, Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W60	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W61	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W64	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W65	1	Yes	Yes?	No	No	Contact bead (WI612), Ceramic type?
	2	No	Yes?	Yes	No	Lamoka Point, Ceramic type?
N82 W66	1	Yes	Yes?	No	Late Woodland	Contact trade bead (WI612), Triangle point, Ceramic type?
	2	Yes	Yes?	Yes	No	Contact trade bead (WI612), Late Archaic point, Ceramic type?
N82 W67	fill/surface	Yes	Yes?	No	No	Contact bead (WI612), Ceramic type?
	1	Yes	Yes?	No	No	Contact bead (WI612), Ceramic type?
N82 W68	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N82 W69	1	Yes	Yes?	No	No	Contact bead (WIIc2), Ceramic type?
	2	No	Yes?	Yes	No	Ceramic type?, Brewerton point (Late Archaic)
N82 W70	1	Yes	No	No	No	Contact flaked olive bottle glass
	2	No	Yes?	No	No	Ceramic type?
N82 W50	1 and 2	No	Yes?	No	No	Ceramic type?
N83 W50	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W55	1	No	Yes?	No	No	Ceramic type?
	2	Yes?	Yes?	No	No	Contact Native pipe bowl?, Ceramic type?
N83 W56	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W57	1	No	Yes?	No	No	Ceramic type?
N83 W58	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W59	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W60	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	Yes	No	Ceramic type?, Brewerton point (Late Archaic)
N83 W61	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W64	1	No	Yes?	No	No	Ceramic type?
	2	Yes	Yes?	No	No	Contact bead (WI612), Ceramic type?
N83 W65	1	Yes	Yes?	No	Early/Middle Woodland	Contact bead (WI612), Early/Middle Woodland point
	2	No	Yes?	Yes	No	Late Archaic point (Lamoka), Ceramic type?
N83 W66	surface	No	Yes?	No	No	Ceramic type?
	1	No	Yes?	No	Late Woodland	Ceramic type?, Shenks Ferry ceramic
	2	No	Yes?	No	No	Ceramic type?
N83 W67	1	No	Yes?	No	No	Ceramic type?
N83 W68	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N83 W69	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	Yes	No	Ceramic type?, Late Archaic point (Brewerton)
N84 W51	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N84 W52	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N84 W53	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N84 W54	surface	Yes	—	—	—	Catlinite bead found in early unit
	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N84 W55	1	No	Yes?	No	No	Ceramic type?
	2	No	Yes?	No	No	Ceramic type?
N84 W56	1	Yes	Yes?	No	No	Ceramic type?, (Contact bead IA18)
	2	No	Yes?	Yes	No	Late Archaic point (Brewerton), Ceramic type?

APPENDIX II

Unit	Level	Contact Artifacts Present?	Clemson Island Artifact Present?	Late Archaic Artifacts Present?	Other Occupation Artifacts Present?	Diagnostic Artifacts
N84 W57	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N84 W58	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N84 W59	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N84 W60	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N84 W61	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	Yes	No	Ceramic Type?, Late Archaic (Brewerton)
N84 W63	1	No	Yes?	No	No	Ceramic Type?
	2	Yes	Yes?	No	Late Woodland	Ceramic Type?, Contact bead (Wlb12), Shenks Ferry ceramic
N84 W64	1	Yes	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	Late Woodland	Triangle point (Late Woodland)
N84 W65	1	No	Yes?	No	No	Ceramic Type?
N84 W68	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	Yes	No	Ceramic Type?, Late Archaic point, Susquehanna Broadspear
N84 W69	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	Yes	Early/Middle Woodland	Ceramic Type?, 2 Late Archaic points, 2 Early/Middle Woodland points
N85 W53	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N84 W54	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N85 W59	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N85 W60	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N85 W61	1	No	Yes?	No	Late Woodland	Ceramic Type?, Shenks Ferry ceramic
	2	No	Yes?	No	No	Ceramic Type?
	3	No	Yes?	No	No	Ceramic Type?
N85 W65	*	Yes	—	—	—	Contact bead (Wlb12)
	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N85 W68	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
N86 W60	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
	3	No	Yes?	No	No	Ceramic Type?
N86 W61	1	No	Yes?	No	No	Ceramic Type?
	2	No	Yes?	No	No	Ceramic Type?
	3	No	Yes?	No	No	Ceramic Type?

Late Archaic Test Units

Unit	Level	Contact Artifacts Present?	Clemson Island Artifacts Present?	Late Archaic Artifacts Present?	Dignostic Artifacts
N78 W45	1	No	Yes?	No	Ceramic type?
N78 W50	1	No	Yes	No	Clemson Island Ceramic
N79 W49	1	No	Yes	Yes	Clemson Island Ceramic, Brewerton Side-notched point
N80 W44	1	No	Yes?	No	Ceramic type?
N80 W48	1	No	Yes?	No	Ceramic type?
N81 W48	1	No	No	Yes	Steatite fragments
	2	No	No	Yes	Steatite fragments
N82 W50	1	No	Yes?	No	Ceramic type?
N83 W47	1	No	No	Yes	Brewerton Side-notched point
N83 W48	1	No	Yes	No	Clemson Island Ceramic
N84 W46	2	No	No	Yes	Brewerton Side-notched point
N84 W47	2	No	No	Yes	Brewerton Eared-notched point
N84 W48	1	No	Yes	No	Clemson Island Ceramic
N84 W49	1	No	No	Yes	Steatite fragments
N86 W48	1	No	No	Yes	Type I stemmed point

APPENDIX III

Vitaes of Principal Investigator and Key Personnel

CURRICULUM VITAE

JAY F. CUSTER
Professor of Anthropology

EDUCATION

B.A.	Franklin and Marshall College, Lancaster, PA	1976
M.A.	Catholic University of America, Washington, DC	1979
Ph.D.	Catholic University of America, Washington, DC	1979

EXPERIENCE

Research Associate, Catholic University Archaeology Laboratory, 1976-1978
Director, Catholic University of America Archaeology Laboratory, 1978-1979
Assistant Professor, Anthropology, University of Delaware, 1979-1984
Associate Professor, Anthropology, University of Delaware, 1984-1989
Professor, Anthropology, University of Delaware, 1989-present
Director, University of Delaware Center for Archaeological Research, 1983-present

RESEARCH INTERESTS

Prehistoric archaeology of Eastern North America, reconstruction of Late Pleistocene and Holocene paleoenvironments, remote sensing applications in archaeology, and prehistoric coastal adaptations.

RECENT RESEARCH

Development of cultural resources management plans for prehistoric archaeological resources in Delaware (1979-1991), funded by the Delaware Division of Historical and Cultural Affairs, and prehistoric and historic archaeological resources in the Upper Delmarva region of Maryland (1983-1985), funded by the Maryland Historical Trust.

Testing and excavation of 120 prehistoric and historic archaeological sites in northern Delaware and New Jersey for the Delaware Department of Transportation (1982-1991) and the New Jersey Department of Transportation (1987-1991).

Development of remote sensing applications to archaeological predictive models using LANDSAT MSS data (1982-1991), funded by the University of Delaware Research Foundation and the National Park Service. Application of these techniques to an archaeological planning study for a 40-mile highway corridor in northern and central Delaware (1983-1986), funded by the Delaware Department of Transportation and the Federal Highway Administration. Application of these techniques to study areas

in coastal Maine and western Virginia highlands funded by the University of Delaware Research Foundation (1985-1987) and in Lancaster County, Pennsylvania, funded by the Pennsylvania Historical and Museum Commission (1988-1989).

Development of a computerized archaeological data base (Delmarva Archaeological Data System) for prehistoric archaeological sites of the Delmarva Peninsula. The 3600 sites in the system have been used to analyze ceramic and lithic raw material exchange systems. Funded by the University of Delaware Research Foundation, the Delaware Bureau of Archaeology and Historic Preservation, and the Maryland Historical Trust.

Private consulting for more than 40 projects involving Phase I and II archaeological studies in Pennsylvania and Maryland. Clients include engineering firms, municipalities, and private developers.

PROFESSIONAL ACTIVITIES

Society of Sigma Xi
Eastern State Archaeological Federation (President 1986-1988)
Society for American Archaeology
Middle Atlantic Archaeological Conference (Chairman of editorial board 1986-present
Southeastern Archaeological Conference
Archaeological Society of Delaware (President 1984-1986, Editor of society journal 1986-present)
Society for Pennsylvania Archaeology (Member editorial board 1982-present, Associate Editor - Pennsylvania Profiles 1986-present)
Archaeological Society of Maryland
Archaeological Society of Virginia (Member editorial board 1986-present)
Associate Managing Editor of **Abstracts in Anthropology** 1987-present
Book Review Editor for **North American Archaeologist** 1984-present
Cultural resource management consultant, United States Department of Agriculture Soil Conservation Service 1986-present
Archaeological Society of West Virginia (Member editorial board 1984-present)

SELECTED PUBLICATIONS

Custer, J. F. and E. B. Wallace (1982). Resource Distribution Patterns and Prehistoric Archaeological Settlement Patterns in the Piedmont Uplands Region of the Middle Atlantic. **North American Archaeologist** 3:139-172.

Curry, D. C. and J. F. Custer (1982). Holocene Climatic Change in the Middle Atlantic Area: Preliminary Observations from Archaeological Sites. **North American Archaeologist** 3:275-285.

Custer, J. F. , V. Klemas, and T. Eveleigh (1983). LANDSAT-generated predictive Models for Prehistoric Archaeological Site Locations on Delaware's Coastal Plain. **Bulletin of the Archaeological Society of Delaware** 14:19-40.

Custer, J. F. (1983). The New River Sampling Simulation: Evaluation of Reconnaissance Level Survey Techniques in Eastern North America. **Southeastern Archaeology** 2(2):73-84.

Custer, J. F., J. M. McNamara, and H. Ward (1983). Woodland Ceramic Sequences of the Upper Delmarva Peninsula and Southeastern Pennsylvania. **Maryland Archaeology** 19(2):21-30.

Custer, J. F. and D. C. Bachman (1983). Phase II Archaeological Investigations at Three Prehistoric Sites: 7NC-D-75, 7NC-E-43, 7NC-E-45, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 25.** Dover

Custer, J. F. (1984). **Delaware Prehistoric Archaeology: An Ecological Approach.** University of Delaware Press, Newark, DE.

Custer, J. F. (1984). Paleoecology of the Late Archaic: Exchange and Adaptation. **Pennsylvania Archaeologist** 54(3-4):32-47.

Custer, J. F. (1984). Prehistoric Lithic Exchange Systems in the Middle Atlantic Region. **University of Delaware Center for Archaeological Research Monograph** 3. Newark.

Coleman, E. C., K. W. Cunningham, W. P. Catts, and J. F. Custer (1984). Phase III Data Recovery at the Wilson/Slack Agricultural Implements Works and Farmstead, Newark, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 23.** Dover.

Custer, J. F. and D. C. Bachman (1984). Phase III Data Recovery Excavations of the Prehistoric Components from the Hawthorn SIte 7NC-E-46, New Churchman's Road, Christiana, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 27.** Dover.

Custer, J. F., P. Jehle, T. Klatka, and T. Eveleigh (1984). A Cultural Resources Planning Study of the Proposed Rt. 13 Relief Corridor, New Castle and Kent Counties, Delaware. **Delaware Department of Transportation Archaeology Series No. 30.** Dover.

Kraft, J. C. and J. F. Custer (1985). Comments on the Holly Oak Shell Controversy. **Science** 227:242-244.

Griffith, D. R. and J. F. Custer (1985). Late Woodland Ceramics of Delaware: Implications for the Late Prehistory of the Northeast. **Pennsylvania Archaeologist** 55(3):5-20.

Custer, J. F. (1985). Analysis of Grave Good Assemblages from the Strickler Site, A Contact Period Susquehannock Site in Lancaster County, Pennsylvania. **Journal of Middle Atlantic Archaeology** 1:33-43.

Custer, J. F. (1985). Prehistoric Ceramics and Interaction Zones on the Southern Delmarva Peninsula. **Quarterly Bulletin of the Archaeological Society of Virginia** 40:145-166.

Beidleman, D. K., W. P. Catts, and J. F. Custer (1985). Final Archaeological Investigations of Block 1191, Wilmington, Delaware. **Delaware Department of Transportation Archaeology Series No. 39**. Dover.

Custer, J. F. (1986). **Late Woodland Cultures of the Middle Atlantic Region.** University of Delaware Press, Newark.

Custer, J. F., T. Eveleigh, V. Klemas, and I. Wells (1986). Application of LANDSAT Data and Synoptic Remote Sensing to Predictive Models for Prehistoric Archaeological Sites: An Example from the Delaware Coastal Plain. **American Antiquity** 51:572-588.

Custer, J. F. (1986). Prehistoric Use of the Chesapeake Estuary: A Diachronic Perspective. **Journal of the Washington Academy of Sciences** 76(3):161-172.

Custer, J. F. and D. C. Bachman (1986). Prehistoric Use of Bay/ Basin Features on the Delmarva Peninsula. **Southeastern Archaeology** 5(1):1-10.

Custer, J. F. (1986). Analysis of Early Holocene Projectile Points and Site Locations from the Delmarva Peninsula. **Archaeology of Eastern North America** 14:45-64.

Custer, J. F. and K. W. Cunningham (1986). Current Research in the Historic Archaeology of Northern Delaware. **Bulletin of the Archaeological Society of Delaware** 21.

Custer, J. F., E. Coleman, W. P. Catts, and K. Cunningham (1986). Soil Chemistry and Historic Archaeological Site Activity Areas: A Test Case from Northern Delaware. **Historical Archaeology** 20(2):87-94.

Catts, W. P., M. Shaffer, and J. F. Custer (1986). Phase I/II Archaeological Survey of the Proposed Route 7 North Corridor, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 47**. Dover.

Custer, J. F. and D. C. Bachman (1986). An Archaeological Planning Survey of Portions of the Proposed Route 13 Corridor, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 42**. Dover.

Custer, J. F., D. C. Bachman, and D. Grettler (1986). An Archaeological Planning Survey of Portions of the Proposed Route 13 Corridor, Kent County, Delaware. **Delaware Department of Transportation Archaeology Series No. 45.** Dover.

Custer, J. F. and S. C. Watson (1987). Making Cultural Paleoecology Work: An Example from Northern Delaware. **Journal of Middle Atlantic Archaeology** 3:81-94.

Custer, J. F. (1987). Problems and Prospects in Northeastern Prehistoric Ceramic Studies. **North American Archaeologist** 8:97-123.

Custer, J. F. (1987). New Perspectives on the Delmarva Adena Complex. **Midcontinental Journal of Archaeology** 12:33-53.

Custer, J. F. (1987). Core Technology at the Hawthorn Site, New Castle County, Delaware: A Late Archaic Hunting Camp. In **The Organization of Core Technology**, edited by J. K. Johnson and C. A. Morrow, pp. 45-62. Westview Press, Boulder, CO.

Custer, J. F., C. De Santis, and S. Watson (1987). An Early Woodland Household Cluster from the Clyde Farm Site (7NC-E-46), Delaware. **Journal of Field Archaeology** 14:229-235.

Custer, J. F., D. C. Bachman, and D. Grettler (1987). Phase I/II Archaeological Research Plan, U.S. Route 13 Relief Route, Kent and New Castle Counties, Delaware. **Delaware Department of Transportation Archaeology Series No. 54.** Dover.

Lothrop, J., C. DeSantis, and J. F. Custer (1987). Phase I/II Archaeological Survey of the Route 896 Corridor, New Castle County, Delaware. **Delaware Department of Transportation Archaeology Series No. 52.** Dover.

Custer, J. F. (1989). **Prehistoric Cultures of the Delmarva Peninsula: An Archaeological Study**. University of Delaware Press.

Custer, J. F. and K. R. Doms (1990). Analysis of Micrograwth Patterns of the American Oyster (Crassostrea virginica) in the Middle Atlantic Region of Eastern North America: Archaeological Applications. **Journal of Archaeological Science** 17(1):151-160.

Custer, J. F. and R. M. Stewart (1990). Environment, Analogy, and Early Paleoindian Economies in Northeastern North America. In **Early Paleoindian Economies of North America**, Research in Economic Anthropology, Supplement 5, edited by B. Isaac and K. Tankersley, pp. 303-322. JAI Press, Greenwich, CT.

Custer, J. F. (1990). Early and Middle Archaic Cultures of Virginia: Culture Change and Continuity. In **Early and Middle Archaic Research in Virginia: A Synthesis**, edited by T. Reinhart and J. M. Wittkofski, pp. 1-60. Archaeological Society of Virginia, Richmond.

VITA

Scott C. Watson

Education:

University of Delaware, Anthropology, B.A., 1984

Research Experience:

August 1981, Prehistoric Archaeological survey of the St. Jones and Murderkill Drainages, Kent County, DE., Crew Member and Supervisor

Summer 1982, Prehistoric archaeological investigations at 7NC-E-42, New Castle County, DE., University of Delaware Field School Supervisor

Winter 1982, Analysis of prehistoric artifact collections from the Wilgus Site (7S-K-21), Sussex County, DE., Lab Supervisor

Spring 1983, Development of National Register Thematic District Nomination for the Delaware Chalcedony Complex, Cecil County, MD.

March - May 1983, Data Recovery at Block 1191, Wilmington, DE., Crew Member

Summer 1983, Prehistoric archaeological investigations at the Arrowhead Farm Site (18-KE-29), Kent County, MD., Crew Member

Sept. - Dec. 1983, Cultural resource planning study of the Proposed Rt. 13 Relief Corridor, New Castle and Kent Counties, DE., Archival Research

Fall 1983, Survey of prehistoric Jasper lithic sources, Newark, DE., Crew Member

Winter 1983, Data recovery at the Wilson Slack Agricultural Implements Works and Farmstead, Newark, DE., Crew Member

Spring 1984, Development of a cataloging system and implementation of a computer generated data base for artifacts excavated by exact provenience

Summer 1984, Prehistoric archaeological investigations at the Clyde Farm Site (7NC-E-6), New Castle County, University of Delaware Field School Supervisor

August - Sept. 1984, Prehistoric archaeological investigations at the Morgan Bank Site (7NC-E-67), New Castle County, DE., Crew Supervisor

Spring 1985, Prehistoric investigations at the Alden Site (7NC-E-74), New Castle County, DE., Crew Supervisor

Summer 1985, Prehistoric archaeological investigations at the Clyde Farm Site (7NC-E-6), New Castle County, DE., University of Delaware Field School Supervisor

Fall 1985, Data recovery for the Proposed Rt. 896 Dualization, New castle County, DE., Crew Supervisor

1986, Artifact analysis of 7NC-E-6A and 7NC-E-63, Research Associate

1986, Steatite Quarrys, Research Associate

1986, Beaver Valley Bridge Replacement, New Castle County, DE., Crew Supervisor

1986, Archaeological Excavations at the Dairy Queen Site (7NC-D-129), New Castle County, DE., Crew Supervisor

1986, Lewden Greene Artifact Analysis, Research Associate

1986, Artifact analysis of the Whitten Road Site (7NC-D-100), New Castle County, DE., Research Associate

Spring 1987, John Ruth Inn (Ogletown), Crew Member

Spring 1987, Old Baltimore Pike Excavations,Crew Member

April - July 1987, DeBraak Ceramic Analysis, Research Associate

July 1987, Hockessin Valley (7N), Crew Member

July 1987 - Feb. 1988, Rt. 38, Burlington Co., New Jersey, Data Recovery Excavations, Project Manager

Spring 1988, Davis Farm Data Recovery, Project Manager

June 1988 - April 1989, Rt. 40 Bypass, Project Manager

1989 - 1990, Brennan Site Data Recovery, Project Manager

1990, Dover Downs Site Data Recovery, Project Manager

1990, 7K-C-360 Site Data Recovery, Project Manager

1990, Leipsic Site Data Recovery, Project Manager

Oct. 1990 Route 404 Archaeological Survey, Project Manager

1990 - 1991, Island Farm Site Phase II and Data Recovery, Project Manager

Aug. 1991- Spring 1992 Carey Farm Site Phase II and Data Recovery, Project Manager

Publications:

1983 Excavations at the Wilgus Site (7S-K-21), Sussex County, Delaware. Bulletin of the Archaeological Society of Delaware 15: 1 - 44. (With J.F. Custer and M. Stiner)

1985 Archaeological Investigations at 7NC-E-42, A Contact Period Site in New Castle County, Delaware. Journal of Middle Atlantic Archaeology 1: 97 - 116. (With J.F. Custer)

Archaeological Investigations at the Arrowhead Farm Site Complex, Kent County, Maryland. Maryland Archaeology (With J. F. Custer, P. Jehle, H.H. Ward, and C. Mensack)

Archaeological Investigations of the Churchmans Marsh Area.University of Delaware Center for Archaeological Research Monograph 4 (With J.F. Custer and C.A. DeSantis)

Archaeological Investigations at the Alden Site (7NC-E-74), New Castle County, Delaware, Manuscript on file, University of Delaware Center for Archaeological Research.

1988 Final Archaeological Investigations of the Replacements of Bridges #17 and #18, on New Castle #221 (Beaver Valley Road), New Castle County, Delaware. Delaware Department of Transportation Archaeological Series no. 62.(With D.J. Grettler and J.F. Custer)

Final Archaeological Excavations at the Dairy Queen Site (7NC-D-129), New castle County, Delaware. Delaware Department of Transportation Archaeological Series no. 63. (With J.F. Custer, A. Hoseth, and E. C. Coleman)

1988 (cont.)

Final Phase III Investigations of the Whitten Road Site 7NC-D-100, Whitten or Walther Road, County Road 346, New Castle County, Delaware. Delaware Department of Transportation Archaeological Series no. 68. (With M. Shaffer, J.F. Custer, D.Grettler, and C. DeSantis)

1989 Phase I Archaeological Survey of the Proposed Route 40 Woodstown Bypass, Salem County New Jersey. New Jersey Department of Transportation.(With A. Hoseth and J. F. Custer)

1990 Phase III Data Recovery Excavations at the Caryatid Site (28-BU-276), and Eckert Farm Site (28-BU-115), Burlington County, New Jersey. New Jersey Department of Transportation. (With J.F. Custer)

Phase III Data Recovery Excavations at the Davis Farm Site (28-GL-133). New Jersey Department of Transportation. (With J.F. Custer)

VITA

Daniel N. Bailey

EDUCATION:

Embry-Riddle Aeronautical University, Aeronautical Studies, A.S., magna cum laude, 1985.

Kutztown University of PA, Anthropology, B.A., summa cum laude, 1988.

RESEARCH EXPERIENCE:

Summer 1989, Historic Archaeological Investigations (Data Recovery) at The Hermitage (Rachel's Garden Excavations), Hermitage, TN, Crew Member/Intern.

October 1989-December 1989, Historic Data Recovery at Darrach's Store (7K-A-101), Smyrna, DE, Crew Member.

December 1989-February 1990, Prehistoric Data Recovery, Brennan I Site (7NC-F-61A), New Castle County, DE, Assistant Crew Supervisor.

February 1990-June 1990, Prehistoric Data Recovery at the Dover Downs Hill A Site (7K-C-365A), Dover, De, Crew Supervisor.

June 1990-August 1990, Prehistoric Data Recovery at 7K-C-360, Kent County, DE, Crew Supervisor.

Summer 1990, Historic Data Recovery at the Queenstown Site(18-Qu-30), Queen Anne's County, MD, Crew Member.

August 1990-October 1990, Prehistoric Data Recovery at the Leipsic Site(7K-C-194A), Kent County, DE, Crew Supervisor.

October 1990-January 1991, Cultural Resource Planning Survey of the Proposed Route 404 Expansion Corridor, Sussex County, DE, Crew Supervisor.

January 1991-March 1991, Prehistoric Archaeological Investigations (Phase 2B) at the Carey Farm Site (7K-D-3), Dover, DE, Crew Supervisor.

March 1991-July 1991, Prehistoric Archaeological Investigations (Phase 2) and Data Recovery (Phase 3) at the Island Farm Site (7K-C-13), Dover, De, Crew Supervisor.

August 1991-January 1992, Prehistoric Data Recovery at the Carey Farm Site, 7K-C-3, Dover, DE, Crew Supervisor.

February 1992-May 1992, Archaeological Investigations (Phase I and II) along Water Street, Lock Haven, PA, Crew Supervisor.

Summer 1992, Report Preparation, University of Delaware Center for Archaeological Research.

July 1992, Phase II Prehistoric Archaeological Investigations at the Hitchens Site, 18-CE-37, Cecil County, MD, Crew Supervisor.

PUBLICATIONS

1992 Watson, Scott, Daniel Bailey, and Jay Custer
Phase I and II Investigations for Cultural Resources Along Water Street, Lock haven, Clinton County, Pennsylvania. Manuscript on file, University of Delaware Center for Archaeological Research, Newark, Delaware.

APPENDIX IV

Location of Materials Generated Under this Contract

APPENDIX IV

LOCATION OF MATERIALS GENERATED UNDER THIS CONTRACT

The materials recovered during the Phase III excavations at Water Street, Lock Haven, Pennsylvania are presently housed at the University of Delaware Center for Archaeological Research. These artifacts will be stored at this location until an ultimate decision of permanent housing for the artifacts is determined by the U.S. Army Corps of Engineers and the non-federal sponsor.